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KODAIKANAL OBSERVATORY (1901—1951)

NEARLY as old as most of the important modern astro-physical observatories of Europe and America, the Kodaikanal Observatory began systematic astro-physical observations in 1901, completing 50 years in March last.

The Observatory started with comparatively simple instrumental equipment such as was in vogue at the beginning of the 20th century. The more important astronomical equipment now in use consists of two spectro-heliographs, a prominence spectroscope, a photoheliograph, a spectrohelioscope, several powerful spectrographs and siderostats and a number of small and moderate-sized telescopes for general astronomical purposes.

Although Kodaikanal specialises in the study of the physics of the sun, it has made contributions to the study of planets, comets and stars as well. By reason of its important researches and of its peculiarly advantageous topographical and geographical position (nearly 7,700 feet above sea level) and its favourable climatic conditions, it is regarded as one of the foremost solar observatories of the world.

Under the auspices of the International Astronomical Union, it co-operates with other important observatories, such as those at Paris, Greenwich, Mount Wilson and Cambridge. It is responsible for the co-ordination of all obser-

vations on solar prominences and dark markings.

This Observatory made its mark early by the discovery of the radial motion in sunspots. Universally known as the Evershed-effect, this phenomenon has been the subject of prolonged study in this as well as in other astro-physical observatories of Europe and America. The observations of the spectra of Venus, Sirius and Nova-Aquilæ carried out at Kodaikanal are regarded as classical studies in astronomical spectroscopy. The original study of solar prominences, dark markings and other solar phenomena, both from the observational and theoretical aspects, made at this Observatory is significant.

However, it appears that the Observatory has not been keeping pace with modern advances in instrumentation. The following is an extract from the brochure issued on the occasion of the Golden Jubilee of the Observatory:—

"Although outstanding contributions on the theoretical side of astronomy and astrophysics have been made by several Indian workers, the corresponding contributions in practical and observational work have not been so significant, largely due to the inadequate instrumental equipment available in Indian Observatories. During the last few years, a number of instru-

ments of basic value in solar research have been built at Kodaikanal, largely through improvisation and local ingenuity at a negligible financial cost. These can and are being utilised for dealing with a variety of problems within their reach; but improvisation, however ingenious, cannot produce the very complex and expensive apparatus of modern astro-physical research which the enormous strides in technological development in the western world have made possible. To mention only the most immediate needs, Kodaikanal Observatory requires a really large solar spectrograph with an adequately powerful cœlostast and other accessories, and a Lyot Coronagraph for modernising its activities in solar physics. These requirements can be met only when adequate funds become available."

The Astronomical Planning Committee of 1945 and the Advisory Board of 1948 have made a number of definite recommendations for the improvement of the Observatory. It is learnt that something has been done towards implementing these recommendations; but a great deal more remains to be done to hasten the pace of astronomical research in this country. It is not merely sufficient to remove the disabilities which existing observatories may be lying under. More observatories must also be established in different parts of the country,

staffed by competent and enthusiastic astronomers, and equipped with instruments capable of yielding results of abiding interest and importance.

In this connection it is appropriate to refer to the spirited plea* made by Sir C. V. Raman some time ago on behalf of astronomical research in India, in the course of which he observes:

"It may be asked, why trouble about astronomy? Why spend money on making great telescopes and building great observatories? These are pertinent questions for which my answer would be that an interest in astronomy is a part of the cultural heritage of India, and that we would be unworthy recipients of that heritage if we did not cherish that interest and do our utmost to promote that science. Astronomy is not only the oldest but the grandest of the sciences. Broadly, it may be described as the investigation of the nature of the physical universe. Defined in that way, we begin to realise that astronomy occupies the premier position among the sciences. Indeed, it may be described as a heaven-born river of knowledge which flows to the earth and fertilises the fields of learning and culture."

* *Curr. Sci.*, 1943, 12, 197, 298, 313.

THE OXFORD CONFERENCE ON LOW TEMPERATURE

AN International Conference on Low Temperature Physics was held in the Clarendon Laboratory at Oxford, from the 22nd to the 28th of August, 1951. The conference was conducted with funds made available by the UNESCO, Union de Physique and Institut International du Froid and was attended by more than two hundred delegates from different parts of the world. Fourteen countries, namely, Australia, Belgium, Canada, China, France, Germany, Holland, India, Japan, Spain, Sweden, Switzerland, United Kingdom and the United States of America were represented. About one hundred delegates were from the United Kingdom and thirty-five each from Holland and the United States. The four Indian delegates were Prof. R. S. Krishnan, Prof. F. C. Auluck, Dr. K. G. Ramanathan and Mr. Chandrasekharan.

Lord Cherwell inaugurated the conference. Prof. F. Simon of the Clarendon Laboratory welcomed the delegates. Introductory speeches were made by Dr. Bleary (Oxford) on 'Recent Advances in Paramagnetism' and by Prof. F. London (Duke University) on the 'Two Fluid Theory of Liquid Helium'. The week of crowd-

ed programme consisted of reading and discussion of over one hundred scientific papers dealing with different fields of current research near the absolute zero of temperature. The papers contributed by different delegates dealt with the thermal, electrical and magnetic properties of solids at very low temperatures and on the extraordinary properties of liquid helium. The wide variety of the problems being tackled indicated the enthusiasm with which physicists are using low temperatures for investigating the physics of the solid state. On the last day of the conference, Prof. Fröhlich gave a brief resumé of his theory of supra-conductivity. The general feeling was that considerable amount of both experimental and theoretical work has yet to be done in Low Temperature Physics before one can give a satisfactory explanation of some of the peculiar phenomena observed very near the absolute zero. One was also surprised to find that very little work appears to have been done so far on the optical properties of solids at very low temperatures.

A detailed report of the Conference is being published by the organisers in a few weeks' time. R. S. K.

WHITHER YEAST GENETICS?

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CYTOLOGY could progress independently of genetics. Genetics on the contrary is dependent on cytology especially since varying grades of polyploidy have been shown to occur in higher plants. For the past fifteen years, yeast genetics has been pursuing a solitary course. The lack of correlation between genetics and cytology has resulted in a very interesting situation. There are as many alternative explanations for the same phenomenon as there are workers!

Roman, *et al.*¹ found an exceptional ascus, the spores in which developed directly into vegetative cultures and gave rise in turn to spores which showed a 2:2 segregation. This observation is believed to be consistent with the polyploidy hypothesis and they suggest that the irregular ratios reported in the so-called "diploids" (Winge and Roberts²; Lindegren³) are capable of a rational explanation. Such a behaviour by some strains is not something unique. Postulating a "direct diploidization" (*parthenogamy* of other workers⁴) Winge and Laustsen⁵ adduced the above as evidence for an "inbreeding degeneration". Lindegren⁶ also records a similar experience. One of his "illegitimate" diploids which ought to have been homozygous gave a 2:2 segregation. He remarks: "This suggests that the illegitimate diploid was heterozygous and indicates that copulation in the single ascospore culture had occurred after mutation made the haplophase heterogeneous" (p. 120). Fowell's⁷ interpretation of the same phenomenon is at variance with that of the others. He found a baker's yeast producing spores and some of the "hap-

loid" cultures obtained by direct germination of the spores, giving rise in turn to spores. Evidences⁷ are offered to show (p. 184) that both the so-called "diploid" and "haploid" cultures can sporulate. Information, however, is not available regarding the segregation ratios in the spores of the so-called "haploids".

The results in Table I thus demonstrate the inadequacy of even the elementary criteria employed by Winge⁸ and Lindegren.⁹ To evaluate the basic causes responsible for such divergence of views one has to go back to the earlier publications. Winge^{8,5} and Lindegren⁹ differentiate "haploids" from "diploids" on pure morphology. The necessity for cytological confirmation, though realized by both these investigators, is discarded on specious grounds. There appears to be no unanimity regarding the relative importance of the characteristics themselves. Skovsted¹⁰ from Winge's laboratory revealed the limitations of these criteria when he stated that transformation of a haploid into a diploid is "much easier to confirm on morphological character than the change from diploid to tetraploid" (p. 250). If polyploidy does not occur in yeast, morphology may have been of some value. The alternative interpretation offered by Roman, *et al.*¹ dissipates any hope of classifying yeasts into "haploids" and "diploids" without accurate cytological confirmation. Let us now assess the value of the characters on which so much reliance has been placed.

SPORE GERMINATION

Since polyploids and diploids sporulate, the direct germination of a spore is no *prima facie*

TABLE I

Actual observations	Starting material	→ Ascus →	Spores →	Veg. cells from direct germination	→ Spores →	2:2 segregation
<i>Interpretations:</i>						
Roman, <i>et al.</i> Fowell Winge	Tetraploid Diploid Diploid		Diploid Haploid Haploid	Diploid Haploid Nuclear fusion giving diploid	Haploid ? Poor viability explained as due to "Inbreeding degeneration"	2:2 No details
Lindegren	Diploid		Haploid	Copulation between cells of the same mating type—"illegitimate" diploid	Haploid	2:2 segregation due to mutations before fusion of haploid cells

evidence for haploidy. There is an unsubstantiated assumption in yeast literature that *regular meiosis* precedes spore formation. The observation of Fowell⁷ that "haploids" do sporulate and that many of the asci are 4-spored necessitates either the belief, (a) that they are not "haploids" or (b) that meiosis is not regular. Since Roman, *et al.*¹ reported a 2:2 segregation one has to presume that the so-called "haploids" of Fowell,⁷ Lindegren⁸ and Winge² may not be *real* haploids at all.

CELL SIZE AND SHAPE

Ignoring the statement of Guilliermond¹¹ that yeast cells are polymorphic, Winge⁵ as well as Lindegren¹³ have tried to justify the reliability of cell size and shape as a criterion. Winge and Laustsen¹² admit that "the form and size of the cells are very susceptible to various cultural conditions" (p. 113). Curiously enough Winge and Laustsen¹⁴ as well as Lindegren⁹ have offered evidence subsequently that cell morphology is itself gene determined. Ditlevsen¹⁵ in fact describes a "diploid" which seems to show the characteristics of the so-called "haploid" cultures. What is more surprising is that Fowell⁷ (p. 183) reports unusually large highly vacuolated cells in his "haploid" cultures confirming the many exceptions recorded in yeast literature (Lindegren,¹³ p. 209; Winge,⁸ pp. 95 and 97).

MATING TYPE ALLELES

The mating type alleles have been brought in as an additional character to identify the so-called "haploids" when they do sporulate (Fowell, p. 184). When he observes unusually large cells in "haploids" Fowell argues that they are still "haploids" because they do not sporulate. But when "haploid" cultures do sporulate he contends that these are still "haploids" because their cells are smaller in size and show a mating reaction when mixed with cultures of the opposite type. Lindegren⁹ is well aware of the limitations of this character. His "illegitimate" hybrids are the result of fusion of cells of the same mating type. Roman, *et al.*¹ visualize the possibility that "illegitimate" hybridization between cells of like mating type would give "a certain proportion of *aa* and *aa* diploids and the mixing of the two clones by Lindegren's methods should produce tetraploids of the type suggested above" (p. 81).

SPORULATION

According to Winge and Laustsen⁵ "haploid" yeasts do not sporulate. Lindegren and Lindegren⁸ on the other hand observed sporulation in some haploids (p. 128). Winge and Laustsen¹² record asporogenous "diploids" (p. 114) while

Fowell⁷ agrees with Lindegren that some haploids can sporulate (p. 184). Roman, *et al.*¹ report (p. 80) a 2:2 segregation in spores of cultures which would normally have been identified as "haploids". It is this 2:2 segregation that appears to have prompted them to give a conventional explanation on the polyploidy hypothesis for the supposed curious segregation claimed in the so-called "diploids".

All the radical theories on "gene conversion", "converter stocks" and "cytoplasmic inheritance" in yeasts have been postulated on the belief that the basic criteria are absolutely correct and incontrovertible. These have been repeatedly asserted without ever considering the possibility of an alternative interpretation. In spite of their divergent views^{2,3} on identical problems, Winge and Lindegren have not offered any elucidation even when they recorded several exceptions to their original basic criteria. Entire dependence on morphology is justified on the plea that the confused nature of yeast cytology necessitates such a procedure. Two years back we¹⁶ stated on the basis of purely cytological investigations that much of the work on the genetics of yeasts will have to be re-evaluated in the light of polyploid segregation. That we are right in our approach would be apparent from such a re-appraisal now attempted by Roman, *et al.*¹

In 1947 and 1948^{17,18} we defined the criteria for the identification of chromosomes and evaluated some contributions on the cytology of yeasts. Winge and Roberts¹⁹ admitted the validity of our criticisms (p. 311). Winge²⁰ now states that our cytological investigations are "of a doubtful nature". If as admitted by Winge and Roberts¹⁹ our criteria are acceptable, then our identification of chromosomes based on those criteria ought to be correct. The recent criticism is not based on any *re-definition* of nuclei or chromosomes in yeasts. It appears to be the expression of a personal opinion. The reasons are obvious, in view of the fact that in the paper in which they report the unique phenomenon of the existence of polymeric genes in a strain of whose polyploid nature they admit they are "totally ignorant", they also dispute our demonstration of an induction of polyploidy. Acceptance of our results would render it impossible to characterize their observations as unique.

Winge's²⁰ criticism that the bodies identified by us as chromosomes are not chromosomes because "they are found scattered in the cytoplasm at all stages" and in a varying number" is entirely at variance with the facts published by

us.^{21,22,23} The pictographic summary published by Subramaniam²¹ as far back as 1946 would be sufficient answer that they are not scattered in the cytoplasm at all stages.

Induction of polyploidy in yeasts was claimed by Bauch²⁴ as far back as 1941. It is really surprising that while Winge and Lindegren classify yeast types into "haploid" and "diploid" on the basis of morphology, polyploids identified on the very same morphological criteria by Bauch²⁴ have received scant attention. The basic cause for all this confusion is lack of organized investigations on the cytology of yeasts. It may be relevant in this connection to remember the salutary comment of Fowell.⁷ "There is a deplorable lack of agreement about the identity of chromosomes in yeast, still more about their behaviour during mitosis and meiosis. In the absence of this vital information, it must be considered premature to dismiss all conventional explanations for irregular segregation ratios and even more premature to elaborate unorthodox theories about gene structure and behaviour" (p. 195).

Yeast genetics is thus at the cross roads. Ordered progress in the future depends on a fruitful association with cytology.

* Italics are ours.

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HIDDEN WEALTH IN THE WASTE OF MANGANESE MINES

AS there is a boom in the manganese market, jigging operations for concentrating small size ore have been started almost at every mine, since ore fragments of the size of one-fifth of an inch thick are marketable. About 50% of the mines are working the so-called "boulder ore" from dumps and virgin ground.

While large amounts of ore of small size termed "Chili" have been reclaimed from the dumps with the help of the improvised jigs, little attention has been paid so far to the 'beneficiation' of the ore from bigger lumps which constitute the major part of the extensive dumps and the *in situ* ore in the veins of some mines. It has been roughly estimated that about three million tons of ore are recoverable from the waste dumps and probably reserves of about 15 million tons exist in the veins. This refers to low grade ore only in the Nagpur and Chhindwara districts. The waste dumps in the Bala-

ghat and Bhandara districts are even more extensive.

The process of reclaiming the ore from the waste will be quite simple and mechanical. Due to high specific gravity of the manganese ores most of the gangue minerals can be separated and the ore concentrated by making use of any of the methods based on gravity. The smaller mines can employ only crushers and carry out the concentration of ore by jigging. In the case of bigger mines and bigger dumps, beneficiation plants of the heavy media separation type of various capacities can be installed. It is understood that portable units of small size for handling five tons of ore per day are also available.

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AGE DETERMINATION STUDIES IN FISHES BY MEANS OF SCALES WITH
SPECIAL REFERENCE TO THE MALABAR SOLE*

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ONE of the outstanding achievements of fishery research during the last half-a-century has been the discovery and application of the method of analysis of the age composition of fish stocks based on the study of growth marks on scales, otoliths and in a few instances vertebrae or other bones. The scales are the most widely used for the purpose and the clue to the age of the fish as given by them is a zonation in their structure, there being 'winter' zones of limited or no growth alternating with 'summer' zones of normal growth and the former standing out as distinct growth rings. In general, while the scales of fishes in the temperate countries present a well marked zonation of this type, those of the tropical fishes seem to lack such distinct markings. In the temperate countries the scale method of age-determination has been used extensively in the case of a large number of species of food fishes.

In India, while work on the age-determination of fishes has been extremely limited, the work that has been done so far on *Hilsa ilisha* and *Sardinella longiceps* have given discouraging results. While some growth rings are known to occur in these two species, there is wide divergence of opinion regarding their exact significance and consequently it has not been possible to utilize them for age-determination. In *S. longiceps*, Hornell and Nayudu¹ have observed not more than two rings and mention that the period of arrested growth coincides with the period of plankton scarcity from January to April. Devanesan² reports many more than two rings and says, "an interpretation of them is beset with difficulties owing to want of collateral researches like marking experiments". But Nair³ records three growth rings in the otoliths of this species and considers that the average life span of the oil sardine is about three years. In the case of *H. ilisha*, Hora and Nair⁴ assume the annual nature of the rings and suggest that *Hilsa* has a life-span of 5 to 7 years. But Prashad, Hora and Nair⁵ report as many as 8 rings and say, "though with the information available at present it is not possible to interpret the exact significance of the scale rings of *Hilsa*, we

believe that they are formed not at regular intervals but whenever the conditions of life become unfavourable". Chacko and Krishnamurthi⁶ suggest that the growth rings of *Hilsa* indicate the number of times the fish has spawned. Chacko, Zobairi and Krishnamurthi⁷ and Sundara Raj⁸ suggest that the transverse radii (and not the growth rings) give an indication of the age of the fish. Jones and Menon⁹ state that though the number of these radii increases with the size of the scale and the length of the fish it is difficult to draw a correct relationship between the radii and the age of the fish. They are also unable to interpret the exact significance of the growth rings. Writing about these growth rings, Sundara Raj¹⁰ states, "These growth rings on *Hilsa* are too numerous to be considered annual growth rings or 'annuli'. Consequently they cannot in the present state of our knowledge provide any evidence of age or rate of growth and must be discarded. This seems to be true also of other tropical fish. Thus to the fishery investigator in India this important clue to the age and rate of growth of fish is denied".

Under these circumstances it is considered worthwhile to report certain of our observations on the Malabar sole, *Cynoglossus semifasciatus* Day, made during the course of our studies on the biology of this species. *C. semifasciatus* is one of the top-ranking food fishes of the Malabar coast. We have noticed in the scales of this species, the occurrence of certain distinct annuli which appear to be formed regularly every year under the influence of the South-West monsoon and which can be used in age-determination and thus in the assessment of the year-class composition of the fishery. These annuli were first noticed in the latter part of 1949 in the scales of the larger individuals in the fishery and have since then been studied in detail. They resemble the annuli described for several flat fishes such as *Lophosetta aquosa*,¹¹ *Platichthys stellatus*,¹² *Citharichthys sordidus*¹³ and *Pleuronectes microcephalus*¹⁴ and are distinct from the rest of the scale by the following features: (i) the narrowing of the sclerites and the closing up of the intervals between successive sclerites, (ii) the sclerites, wavy and broken up elsewhere, becoming continuous and nearly straight from radius to radius, (iii) an increase in the number of

* Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam.

radii outward of the annulus, the new radii commencing just near the annulus, and (iv) the portions of the radii outward of the annulus being frequently not in a straight line with the portions inward of it, but inclined at an



Photomicrographs of Scales of *Cynoglossus semifasciatus*.

A. Scale showing two annuli. $\times 10$. (Female, total length 15.5 cm., ovary in stage V, captured on 17th January 1951). B. Scale showing one annulus. $\times 10$. (Female, total length 15.6 cm., ovary in stage V, captured on 9th May 1951). C. Scale showing no annuli. $\times 10$. (Female, total length 11. cm., ovary in stage III, captured on 9th May 1951).

angle or even disconnected at the annulus. Photomicrographs A, B and C show scales of *C. semifasciatus* with two, one and no annuli respectively. Scales with more than two annuli have not been noticed so far. Several otoliths have also been examined but no rings have been noticed in them.

The breeding season in the case of the Malabar sole is spread over a long period, starting from about October and continuing up to about May of the following year. There is thus a very short break in the recruitment of young ones to the fishery and except during the earlier months of the breeding season when the new recruits remain quite distinct from the members of the older generations, it is difficult to recognize the different age-groups by means of a length frequency curve as the modes in the latter do not stand out clearly. During the year 1950-51 however, it was possible to watch carefully the stock of the preceding pre-monsoon period during its passage through the fishery, by a study of periodical random samples taken during different months of the year. The following table summarizes the data relating to the occurrence of growth rings in random samples of this stock during the period September, 1950, to December, 1950.

As is evident from this table, the rings appeared gradually at the margins of the scales and growth occurred subsequently outside the rings. While the majority of the individuals examined in September had already developed the annuli by then, in others the appearance of the annuli was noticed only a little later. But in November out of 248 individuals, only two were without rings and of the others only two had 'closed' (that is, still not growing) margins. In December and subsequent months all individuals of the previous pre-monsoon generation without exception, revealed the presence of rings and 'open' (that is, growing) margins. Large numbers of individuals of the new post-monsoon generation (which were widely distinct from the rest until February) were also examined and found to have no annuli at all. No rings were found on the scales of the new recruits during the year 1949-50 also, and no 'closed' margin phase occurred in individuals of any size before the monsoon season.

The growth rings occurring in the scales of fishes in the temperate countries are indicative of seasonal differences in growth and are obviously related to the regularly occurring seasonal

TABLE I

	September	October	November	December
1 Total number examined	405	81	248	102
2 Number with no rings	45	16	2	0
3 Number with one ring and 'closed' margin	178+23 (not clear)	9+2 (not clear)	0+2 (not clear)	0
4 Number with one ring and 'open' margin	124+15 (")	46+1 (")	231	95
5 Number with two rings and 'closed' margin	12+4 (")	1	0	0
6 Number with two rings and 'open' margin	1+3 (")	6	8+2 (not clear)	7

differences in the environmental factors. The general lack of growth rings in the scales of the tropical fishes as well as the indistinctness of and the difficulty in the interpretation of such marks of growth check as do occur in some of the species must be mainly due to the fact that the seasonal differences in the tropical countries are neither similar to nor so well marked as in the temperate countries. There is some evidence to show that the growth rate of fishes suffers a decrease and rings tend to be formed in the scales whenever environmental conditions such as for instance, food and temperature, are unfavourable.^{15,16} In some Indo-Chinese species of fishes Chevey¹⁷ has noticed growth rings in the northern but not in the southern region and he attributes this to temperature differences between the two areas; he also records¹⁸ some exceptional species from Cochinchina in which the growth rings are found and considers that the rings are caused by the rhythmical occurrence of favourable and unfavourable conditions of nourishment in the environment. The usefulness of the rings found in the scales of any fish for age-reading would therefore depend upon the frequency and the cyclical regularity with which conditions unfavourable to the growth of the species occur in its environment.

Along the Malabar coast, the environmental conditions in the inshore sea during the monsoon months (June to August), are quite distinct from those during other months of the year, and are characterised by a sharp fall in salinity and temperature, a high turbidity and turbulence and above all by the sea bottom becoming severely depleted of the organisms which form the chief food of *Cynoglossus*. The last point has been brought out clearly by our studies of the feeding habits of the Malabar sole and by the study of the bottom fauna near Calicut by one of us (G. S.). The change in the environmental conditions seems to occur regularly every year more or less during the same period and thus the events are regularly cyclical. It seems reasonable under these circumstances to conclude that the annuli mentioned above are annual rings formed under the influence of the South-West monsoon season and it would be appropriate to name them monsoon rings. The main factor causing the formation of these rings appears to be the lack of food leading to starvation. They are not spawning marks because even individuals that have clearly not yet reached the first spawning stage show them, provided they do not belong to the current year's brood.

Our studies of the scale rings of *C. semifasciatus* indicate that no individuals of this species which have survived more than two mon-

soon seasons occur in this area and that fish which have passed through two monsoon seasons themselves form a very insignificant part in the fishery. These studies also indicate that during the 1949-50 and 1950-51 fishery seasons the great majority of the soles contributing to the fishery were the direct result of previous season's spawning, the catches of the peak period (September-November) being traceable to the stock of post-larvæ and young soles occurring in the area during the months preceding the monsoon. Whenever the fishery extends beyond the usual season, that is, into the pre-monsoon months of the next calendar year, the bulk of the catches of these later months is likely to consist of recruits of the same season. While it is yet too early to reach any far-reaching conclusions as to the application of these results, a systematic collection of data for some more years should prove to be of considerable value in evolving suitable methods for the management of this important fishery.

It is suggested that annuli similar to those seen in *C. semifasciatus* are likely to occur in other species of the area, especially if they are mainly dependent on the bottom fauna for food. It also seems reasonable to assume that a search for annual scale rings would be worthwhile, even in the tropical countries, wherever the environmental conditions differ markedly and regularly between one part of the year and another.

We are thankful to Professor B. R. Seshachar for help in getting the scales photographed, and to Dr. N. K. Panikkar for helpful criticism.

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THE PHYSICAL SIGNIFICANCE OF A CLASS OF METRICS

It is obvious that the Riemannian metric of general relativity cannot always be reduced to the form

$$ds^2 = -A dx^2 - B dy^2 - C dz^2 + D dt^2, \quad (1)$$

where A, B, C, D are functions of co-ordinates. It is well known that if the metric is to reduce to the above form the coefficients of rotation (Eisenhart, 1949 a) must satisfy the conditions,

$$\gamma_{ijk} = 0, \quad (i \neq j \neq k) \quad (2)$$

for an associated orthogonal ennuple. The question naturally arises as to what is the physical significance of the conditions (2). So far this has not been answered.

Recently, while examining the distant-parallellism theory of Einstein (1928 a, b; 1929) which was later modified by Levi-Civita (1929), we noticed that the electromagnetic field totally disappears for a metric of the form (1). In the

theory, the gravitational field is given by the equation in quadruplet tensors,

$$G_{ik} - \frac{1}{2} \delta_{ik} G = -K T_{ik}, \quad (3)$$

where K is the usual constant. The electromagnetic quadruplet tensor F_{ik} is defined by

$$F_{ik} = \nu \sum_1^4 e_i \frac{d\gamma_{ik}}{ds_i}, \quad (4)$$

where $e_1 = e_2 = e_3 = -e_4 = -1$, $\frac{d}{ds_i}$ is the operator of directional differentiation and ν is a constant.

When we make use of the conditions (2) and the identities (Eisenhart, 1949 b).

$$\frac{d\gamma_{lpp}}{ds_i} - \frac{d\gamma_{rpp}}{ds_i} + e_1 \gamma_{lpp} \gamma_{lpp} - e_1 \gamma_{lpp} \gamma_{rpp} = 0, \quad (5)$$

we can easily verify that the components of the electromagnetic field vanish. This interesting result does not seem to have attracted attention before.

In the more recent theories of Einstein and Schrödinger unifying the gravitational and elec-

tromagnetic fields the latter is associated with the cross-terms in the metric. This is in harmony with the result stated above. We thus find, at least in certain contexts the physical significance of the reducibility of the metric to (1).

The result reported here was anticipated by Professor V. V. Narlikar at whose suggestion I have carried out all the relevant calculations. Benares Hindu University, RAMJI TIWARI.
August 17, 1951.

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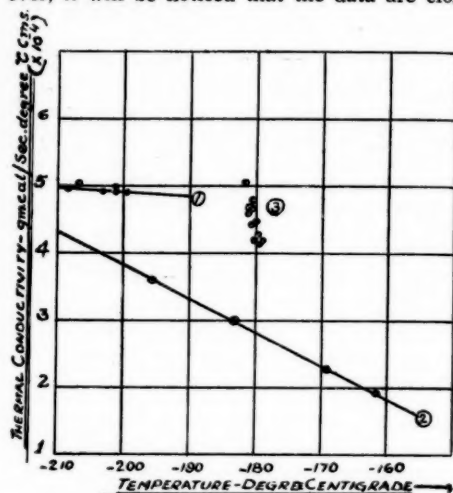
THERMAL CONDUCTIVITY OF LIQUID NITROGEN

THE data on the thermal conductivity of liquid nitrogen have been reported from two sources: by Hammann¹ between -199.7°C . and -208.5°C . and by Borovik, Matveev and Panina² between -161.4°C . and -195.3°C . Considerable discrepancy, however, is found to exist between the two sets of the data. No explanation about this discrepancy has been reported so far.

Recently the author in collaboration with Dr. G. G. Haselden³ carried out some investigations on the transfer coefficient for condensing nitrogen vapour. In this investigation condensation of the vapour was brought about between 4 to 6 atmosphere pressure on the outside of a vertical copper tube and the latent heat was absorbed by boiling liquid oxygen inside the tube at atmospheric pressure.

Nusselt⁴ deduced a theoretical equation for predicting the heat transfer co-efficient for pure saturated vapour on a vertical surface. In deducing the equation he specified a number of conditions relating to the vapour and liquid flow and the temperature distribution in the system. Various workers have reported discrepancy between the experimental and Nusselt values. These discrepancies have been attributed mainly to the divergence of the experimental conditions from Nusselt's assumptions. In the design and operation of the present experimental apparatus every attempt was made to conform to the conditions required by Nusselt's assumptions. The values of thermal conductivity of liquid nitrogen between -181.6°C . and -179.1°C . have been calculated from the heat transfer data given in Table II of reference.³ The points are fairly scattered as is generally

the case with heat transfer data (Fig. 1). However, it will be noticed that the data are closer



- (1) Data of Hammann
(2) Data of Borovik et al.
(3) Experimental Data

to Hammann's data than those of Borovik, et al. The mean value is 4.48×10^{-4} cal./sec./ $^{\circ}\text{C}$.cm. at the mean temperature of -180.3°C .

Indust. Res. Lab., SURAJDEO PROSAD.
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MAGNETO-OPTIC DETECTION OF RADIO-FREQUENCY RESONANCE

OPTICAL means of detecting radio-frequency resonance among the Zeeman levels of an atom in a magnetic field have been sought for and discussed by many workers.^{1,2,3,4} Bitter¹ was the first to suggest that the intensity, polarisation and frequency of the optical radiation emitted, corresponding to transitions between two levels, are altered when one of the levels is under radio-frequency resonance. Pryce² showed that the magnitude of the effect was proportional to the r.f. magnetic field and that it would be rather difficult to observe the optical changes unless the Zeeman components are almost completely resolved. Although the direct

observation of the changes in the optical radiation is difficult, it occurred to the authors that the magneto-optic rotation, which is very sensitive, particularly near the absorption line, to the magnitude of the Zeeman splitting, would be an excellent means for detecting the radio-frequency resonance. The order of magnitude of the effect to be expected is discussed below.

The energy levels of an atom in the $^2S_{1/2}$ state placed in an r.f. field has been calculated by Pryce² to be

$E = \pm \frac{1}{2} \hbar \omega \pm \frac{1}{2} [h^2 (\omega_0 - \omega)^2 + (g \mu_0 H_{r.f.})^2]^{1/2}$, where ω , ω_0 and $H_{r.f.}$ are respectively the applied frequency, the resonant frequency and the r.f. magnetic field. Fig. 1 shows how the

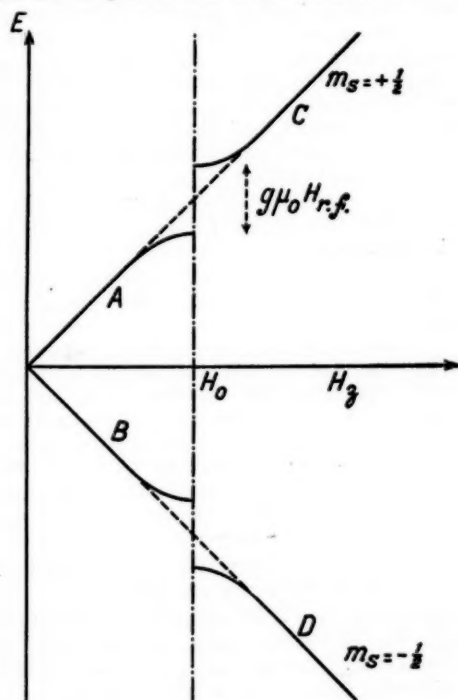


FIG. 1

energy levels vary with the magnetic field H_z . On approaching resonance the energy difference between $m_s = +\frac{1}{2}$ and $m_s = -\frac{1}{2}$ increases with H_z at a rate slower than it would in the absence of the r.f. field. At resonance the levels are interchanged on account of the absorption and emission of r.f. quanta. Thus, the energy of an atom originally in the state $m_s = +\frac{1}{2}$ increases with the magnetic field and follows the curve A in Fig. 1. At resonance the atom emits an r.f. quantum of energy $\hbar \omega_0$

and goes over to state $m_s = -\frac{1}{2}$ and follows the curve D. Similarly the energy of an atom in the state $m_s = -\frac{1}{2}$ goes from curve B to C by the absorption of a quantum at resonance. The four effective levels given by the curve exist only at resonance and not over a range about resonance as a cursory examination of the curve appearing in Pryce's paper might indicate. It is to be noted that the energy levels are different on either side of resonance. Consequently the Zeeman splitting of the spectral lines arising from transitions from a higher level to a level under the action of an r.f. field will be slightly different before and after resonance. The magnitude of the difference would be approximately $2g\mu_0 H_{r.f.}$

Now the magneto-optic rotation is dependent on the magnitude of the Zeeman splitting of the states of an atom. From the classical experiments of Wood⁵ on the magneto-optic rotation in sodium vapour we know that even at 2 Å away from the absorption frequency the magnetic rotation is of the order of 0.2° per Oersted. At moderate radio-frequencies (~ 100 m.c.) it is possible to attain r.f. fields of the order of 1 to 10 Oersteds. The constant magnetic field required to produce resonance at this frequency is about 35 Oersteds. Thus, if the reasoning given above is correct, we should expect to find a sudden change in the magneto-optic rotation of the order of 0.1° to 2° on crossing the resonance value.

The magnitude of the magneto-optic rotation is also dependent on the transition probabilities associated with the lines whose frequencies are shifted by $g\mu_0 H_{r.f.}/\hbar$. That these transition probabilities are not very different from the values when the r.f. field is absent is evident from Pryce's calculations. Even if the transition probabilities are much smaller in the r.f. field, it should be possible to detect by electronic methods the variations in the magneto-optic rotation near resonance.

Periodic fractional changes in light intensity of the order of 10^{-7} can be detected by the use of a photomultiplier tube with a tuned amplifier having a narrow band-width. So by amplitude or frequency modulating the r.f. it should be possible to detect changes in rotation of the order of $0.1'$ of arc. Experiments have been undertaken to verify the above ideas.

It may be mentioned that the effects discussed above are quite different from the changes in magneto-optic rotation that may occur due to equalisation of population in paramagnetic resonance which however will be prominent only at low temperatures.

The authors thank Prof. R. S. Krishnan for his keen interest in this investigation.

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ON THE OCCURRENCE OF TWO-WINGED POLLEN IN THE TRIASSIC ROCKS OF THE SALT RANGE, PUNJAB

SOME years ago, the author¹ described a number of siliceous casts of micro-organisms from the Triassic rocks of the Salt Range, Punjab. About a year after the publication of the paper describing these micro-fossils, Dr. D. D. Pant of Allahabad was good enough to examine the original specimens. He suggested that they were most probably casts of two-winged spores. He has since then published a note in *Nature*² in which he says that they should be referred to *Pityosporites* Seward. In view of Pant's observations, it seems useful to give the correct botanical description of the fossils. The author believes that Dr. Pant is right in interpreting them as casts of two-winged spores.

Description.—The specimens are preserved in the form of siliceous casts of a red-brown colour which is due to the presence of iron oxide in the infilling material. The surface does not show any ornamentation and the specimens appear in some cases to have suffered distortion. Owing to the imperfect preservation the correct form and sculpturing of the spore body is not seen and it renders comparisons difficult. If the specimens are internal casts like the megaspores associated with them, one should expect signs of a reticulum in the region of the bladders. The casts, however, show a uniform smooth texture.

There are at least two spore types present. The first has swollen distally inclined bladders as in *Pityosporites* Seward. The specimens measure about 145 μ from wing to wing. In the second type the bladders are not swollen and are placed symmetrically on either side of the central body. This type is more comparable to *Alisporites* of Daugherty. The specimens in this case are slightly larger (148 μ).

Both *Pityosporites* and *Alisporites* have been redefined by Schopf, Wilson and Bantall.³ The more restricted use of the two generic

terms suggested by these authors calls for accurate comparisons which are not possible with the present badly preserved specimens. The Salt Range fossils are therefore not being assigned to these genera, though resemblance with them is obvious. They are more conveniently described by Naumova's more elastic terminology, *Saccata* with its further divisions *Oedemosaccus* (air sacs swollen) and *Platysaccus* (air sacs flat).⁴

Two-winged spores of the *Pityosporites* and the *Alisporites* type have been previously recorded in India both from the Lower and Upper Gondwana rocks. They occur in the Salt Range in the Permo-Carboniferous and the Permian beds⁵ and the Jurassic rocks of the Rajmahal Hills, Behar.⁶ We now know that these types ranged uninterrupted in the Gondwana flora of India from the Permo-Carboniferous through the Trias to the Jurassic period. The present spores are characterised by their rather larger size as compared to the Palaeozoic and the Jurassic types from India.

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August 9, 1951.

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VITAMIN B₁₂ AND NITROGEN EXCRETION BY HUMAN ADULTS

PATWARDHAN, *et al.*¹ and Karambellkar, *et al.*² have reported that adult human subjects excreted more nitrogen through urine on animal protein rich diets than on diets containing the same quantity of total proteins, but where the protein was chiefly of vegetable origin. No satisfactory explanation for this observation has yet been found. Various workers have suggested (see below) that vitamin B₁₂ influences favourably the utilisation of dietary protein. Further, a close relationship between "Animal Protein Factor" and vitamin B₁₂ has been reported by Ott, *et al.*³ In view of these facts, it was considered worthwhile testing the effect of the former on the urinary nitrogen excretion in human subjects maintained on diets providing

protein mainly of vegetable origin. That vitamin B₁₂ promotes the utilisation of protein in rats and of amino acids in chicks has been observed by Hartman, Dryden and Cary⁴ and Charkey, *et al.*⁵ respectively. Abbot⁶ observed that injection of vitamin B₁₂ resulted in marked nitrogen retention in rabbits on unrestricted diets. The positive nitrogen balance, however, was slight when the diet was restricted. Marfatia and Sreenivasan⁷ have recently reported significant increases in the biological value and digestibility coefficient of low quality protein mixture on supplementation with vitamin B₁₂. The following experiment was undertaken to find out if vitamin B₁₂ exerted any influence on protein metabolism in human adults.

Two healthy male adults volunteered as the subjects for this experiment. They were fed on a controlled diet of the following composition: Cereals 530 gm., Pulses 90 gm., Leafy vegetables 100 gm., Non-leafy vegetables 150 gm., Whole milk powder 14 gm., Sugar 70 gm., Vegetable oil 50 gm., Condiments and spices 30 gm., Tea leaves 15 gm. The diet had the total caloric value of 3,260 and provided 76.6 gm. protein (12.25 gm. N), of which only 3 gm. were animal protein, the rest being derived from cereals, pulses and vegetables.

After two weeks on experimental diet for the attainment of steady state with respect to urinary nitrogen excretion, the collection of urine and faeces for nitrogen determinations was made continuously for eight days. Then 15 µg of vitamin B₁₂ were administered intramuscularly. A second dose of 15 µg was repeated on the fourth day following the first one. The urine and faeces were collected continuously for six days from the first administration of vitamin B₁₂ and nitrogen determined in the excreta. The average figures for daily N excretion in urine and faeces during the control and B₁₂ supplementation periods are given in the following table:

TABLE I

Subject	Control period		After vitamin B ₁₂	
	Nitrogen excretion per day in g.		Nitrogen excretion per day in g.	
	Urine	Faeces	Urine	Faeces
C.S., 29 years. Body weight 138 lb.	5.46	1.64	5.53	1.45
N.K., 20 years. Body weight 112 lb.	7.33	1.66	7.19	1.76

It can be seen from the results that there has been no significant difference in the urinary and faecal nitrogen excretion on a daily intake of 12.25 gm. N, hence no appreciable change in nitrogen retention could be detected in both the subjects between the control and vitamin B₁₂ periods. The figures for faecal N also indicate that there has been little change in the digestibility of protein subsequent to administration of vitamin B₁₂.

Although there is considerable evidence to show that vitamin B₁₂ has an important role to play in amino acid metabolism (Schäfer, Salmon and Strength,⁸ Oginsky,⁹ Jukes, Stockstad and Broquist¹⁰) it has not always been possible to demonstrate its effect on the utilisation of dietary protein. Some of the evidence published on this aspect is more or less circumstantial. Chow and Barrows¹¹ observed better growth in young rats on vitamin B₁₂ supplementation to a soya bean protein diet without any change in the biological value of the protein. They attributed this to a possible role of the vitamin in carbohydrate or fat metabolism. Rupp, *et al.*² have also reported that vitamin B₁₂ administered to rats receiving constant food intake exerted no influence on nitrogen retention. McCollum and Chow¹³ found greater growth in female rats after injection of vitamin B₁₂ with high carbohydrate diets which suggested that vitamin B₁₂ is possibly involved in the conversion of carbohydrate to fat. Chow¹⁴ did not notice any increase in nitrogen retention when vitamin B₁₂ was given parenterally to infants fed on soyabean protein diets.

The conclusions regarding the influence of vitamin B₁₂ on protein utilisation to which a reference has been made above were based mainly on the increased rate of growth observed in the animals. The increase in growth rates on vitamin B₁₂ supplemented rations was probably the result of increase in food consumption to which attention has been drawn by the workers concerned. So far as the published evidence goes, it must be admitted that unequivocal proof of the existence of a specific effect of vitamin B₁₂ on the utilisation of dietary protein is still lacking. Our own observations reported above, limited as they are, lend no support to this view.

Further work on adults and children is in progress and will form the subject of a fuller communication to be published elsewhere.

Nutrition Res. Labs., P. G. TULPULE.
Ind. Council of Med. Res., B. V. RAMA SASTRI.
Coonoor, South India, V. N. PATWARDHAN,
June 8, 1951,

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AMINO ACIDS IN FINGER SEED (RAGI KURAKKAN) ELEUSINE CORACANA

My attention has been drawn to a paper by Lal¹ in which he concludes that Ragi (*Eleusine coracana*) and Bengal Gram (*Cicer arietinum*) are totally deficient in the essential amino acid threonine. A paper published by me² a little earlier gives the threonine nitrogen content of Kurakkan (as this cereal is called in Ceylon) as 3.2% of the total nitrogen present, the determination being carried out on the fat extracted material by the periodate oxidation method.³ Numerous threonine estimations by this method have been made during the last three years on a variety of foodstuffs in this laboratory; close agreement has been observed with the values obtained by the method of microbiological assay.

A total deficiency of threonine in Ragi would militate against the use of this valuable millet in tropical diets. It was considered desirable therefore to confirm by microbiological assay the threonine value obtained by the oxidation procedure. For this purpose, two hydrolysates of the fat extracted cereal were prepared, one by hydrolysis essentially according to Lal's procedure and the other by boiling for 24 hours with excess of 20% hydrochloric acid. Each hydrolysate was assayed with each of two different media,^{4,5} the organism used being *Streptococcus faecalis*. The results for each hydrolysate with the different media were in close agreement and averaged as follows:—

Threonine N (in pressure hydrolysate)	= 3.04% of total N.
Threonine N (20% HCl hydrolysate)	= 2.95% of total N.
Mean	= 3.00% of total N.

This value is in good agreement with the value 3.2% obtained by the periodate oxidation procedure. If the threonine nitrogen is taken as the mean of these two figures, the percentage of threonine in Ragi (anhydrous, lipid free, N = 1.26%) works out as 0.332%.

As the lipid content of the whole millet is small (of the order of 1-2%), it is seen that a value of 0.32-0.33% would be representative of its threonine content on an anhydrous basis. It would appear unlikely also that Bengal Gram is lacking in threonine as this essential amino acid appears to be fairly uniformly distributed in other legumes.

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Colombo, Ceylon,
July 19, 1951.

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THE "PHENOLASE" FROM BRINJAL (*Solanum melongena*)

HIGHLY purified phenolase preparations have been prepared from potato,¹ common mushroom,² wild mushroom,³ sweet potato⁴ and the field bean (*Dolichos lablab*).⁵ All these phenolases excepting that from wild mushroom have been shown to oxidise polyphenols, viz., catechol, very rapidly. The phenolase from wild mushroom however was shown to be 10 times more active towards monophenol-p-cresol than towards polyphenol-catechol. The pressed juice of the brinjal (*Solanum melongena*) rapidly darkens in air, indicating the presence of a phenolase, which has now been elucidated.

The dark juice obtained from brinjals by mincing and pressing was treated with an equal volume of anhydrous acetone. The resulting precipitate which practically contained the whole of the enzyme, was redissolved in the minimum amount of water. The dark solution on saturation with ammonium sulphate, precipitated the enzyme. The precipitate was taken up in water and dialysed against run-

ning water. To the dark red solution thus obtained, the required quantity of 0.1 saturated basic lead acetate was added so that a brown turbid solution containing about 70 per cent. of the original enzymic activity was obtained. To this solution a small quantity of calcium phosphate gel was added to remove the turbidity. The colour of the enzymic solution thus obtained was light brown. The enzyme in the solution was further purified by two successive adsorptions on $\text{Ca}_3(\text{PO}_4)_2$ gel and two successive elutions with K_2HPO_4 solutions. This brown coloured solution was used for a study of properties of the enzyme. It could be further purified by treatment with basic lead acetate solution at pH 7.5.

The following table indicates the effect of purification on the activity of the enzyme as determined manometrically towards a representative polyphenol (catechol) and monophenol (*p*-cresol).

The results are expressed in terms of QO_2 , i.e., uptake of oxygen in c.mm. as measured in a warburg manometer per mg. enzyme per hour. The uptake per hour was determined on the basis of uptake in the first two minutes of the reaction.

The optimum pH with catechol was found to be 6 and optimum concentration of catechol as the substrate to be 2 mg. in the final volume of 2.5 c.c. The corresponding values for *p*-cresol were pH 7 and 10 mgms. respectively.

Activity of the enzyme during different stages of purification

No.	Purification Stages	QO_2 Catechol	QO_2 <i>p</i> -Cresol	Ratio of Catechol to <i>p</i> -Cresol
1	Crude juice	12	8	1.66
2	Precipitate with acetone in water	86	41	2
3	Precipitate with ammonium sulphate in water	596	208	3
4	Filtrate after lead acetate precipitation	910	170	5.3
5	Filtrate after 1st adsorption on $\text{Ca}_3(\text{PO}_4)_2$ gel	1123	180	6.1
6a	Enzyme adsorbed on $\text{Ca}_3(\text{PO}_4)_2$ gel eluted	1770	209	8.9
6b	Enzyme (6a) adsorbed on $\text{Ca}_3(\text{PO}_4)_2$ gel and eluted	3725	195	19
7	Enzyme solution after lead acetate precipitation	4529	160	28

From the above table it is clear that there is a progressive increase in the activity ratio catechol: *p*-cresol. Further, the oxidation of *p*-cresol was found to commence after a lag period,

which also increased with progressive purification. This lag period can be reduced by adding a trace of catechol to the system.

The brinjal phenolase, like the phenolases from mushrooms, potato and sweet potato was found to be a copper protein containing 0.2% copper, and was inhibited by NaCN, H_2S and sodium diethyl dithio carbamate. Of the monophenols and polyphenols tested such as phenol, *p*-cresol, tyrosine, catechol, hydroquinone, *p*-phenylenediamine, pyrogallol, phloroglucinol, catechol was found to be the most reactive towards the enzyme.

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INFLUENCE OF ANTIBIOTICS ON
THE GROWTH OF THE SILKWORM
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INTESTINAL flora of animals are known to exert a beneficial effect on their hosts by synthesising vitamins and growth factors. This was first demonstrated in the case of rats in 1927.¹

Black, et al.² reported a retardation in the growth of rats by feeding them with sulphaguanidine at a level of .5 per cent. This finding was extended by others^{3,4,5,6,7} who used other sulphad drugs as bacteriostatic agents. Daft and Sebrell⁸ and Elvehjem⁹ have reviewed much of this work.

More recently, however, certain chemotherapeutic agents, when orally administered, have been shown to promote an increased response of growth in various species of animals. Succinyl sulphathiazole, arsonic acid derivatives,^{10,11} crystalline antibiotics^{12,13} and crude fermentation products prepared from antibiotic fermentations,^{14,15} have, for example, been found to exert pronounced growth-promoting activity in chicks, rats and pigs.

In the course of our studies on the nutrition of the silkworm, we were confronted with the problem of avoiding heavy intestinal infections among silkworms, particularly when they were fed with mulberry leaves supplemented with protein hydrolysates. The use of antibiotics in controlling diseases, viz., diarrhea has been reported by Carpenter¹⁶ in his recent studies of the

effect of antibiotics on the growth of swine. Our object in using the antibiotics, penicillin and streptomycin, along with the protein hydrolysates, was to determine if the micro-organisms responsible for the intestinal diseases of the silk-worm could be controlled.

Two batches of each of 10 silkworm larvæ of the Mysore-Japanese cross-breed (Mysore \times C. Nichi₁), immediately after the III moult, were employed to determine the effect of each of the supplements. The average initial weight of the larvæ was near about 800 mg. and the weights of the batches did not differ from the average by more than 0.65 per cent. For each group of 20 larvæ under a given treatment 200 mg. portions of acid hydrolysates of casein, gelatin, and silk were fed twice a day during the IV instar and four times a day during the V instar. The larvæ were observed to consume about 50 per cent. of the supplement during the IV instar and about 25 per cent. during the V instar.

In the case of larvæ which received an antibiotic 1,000 units of penicillin or 20 μ g. of streptomycin were given on alternate days along with the feed for each group. The average increase of weights of 10 larvæ commencing from the start of the experiment to the time of mounting are given in the following table.

The data given in the table show that penicillin and streptomycin when administered to the

to elucidate the mechanism of the beneficial action of antibiotics on the growth of the worm and the yield of silk.

Our grateful thanks are due to the Governments of India and Mysore for their financial assistance and to the Director, I.I.S., for his kind interest.

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Treatment	Protein hydrolysates without antibiotics			Protein hydrolysates with antibiotics			
	Leaf + casein hydrolysate	Leaf + gelatin hydrolysate	Leaf + silk hydrolysate	Leaf + casein hydrolysate + streptomycin	Leaf + casein hydrolysate + penicillin	Leaf + gelatin hydrolysate + penicillin	Leaf + silk hydrolysate + penicillin
Average increase of weight of 10 larva during experimental period (in g.)	15.7066	15.6434	15.7765	16.8747	16.7215	16.7077	16.3067

larvæ along with protein hydrolysates help to bring about a definite and significant increase in the body weight of the larvæ, varying between 2.5 to 6.8 per cent. It is suggested that these antibiotics, as in the case of similar studies, exert a beneficial influence in controlling the intestinal flora of the larvæ. It has also been found that higher meterages of reelable silk are obtained with cocoons spun by worms fed on diets fortified with antibiotics. These studies are being extended to other antibiotics, viz., chloromycetin, aureomycin, terramycin, with a view

TREATMENT OF RICE SEED IN NUTRIENT SOLUTIONS AS A MEANS OF INCREASING YIELD

STUDIES on the effect of soaking the seed prior to sowing in nutrient solutions have been made by Gusev,¹ Roberts,² Narayanan and Gopalakrishnan³ and Chandraratna and Abeyaratna.⁴ In view of earlier success recorded by Roberts² with cereals in Great Britain and considerable economy in fertilizer use effected by this method, work on soaking of rice seed in nutrient

solutions was started in 1948, at the Central Rice Research Institute, Cuttack, to see how far this method could be utilised to correct mineral deficiencies in soil, to obtain higher yields of grain. A number of chemicals each at three concentrations 2M, M and M/2 and treatment with cow dung paste and water soaking were tried. Soaking of seed was done in 1/3 its weight of nutrient solution for 24 hours in an end-on shaking apparatus to effect uniform mixing. The treated seeds were then sun-dried and stored in closed containers for nearly 30-40 days before sowing. No adverse effect on germination was observed due to storage. The treated seeds were then sown in phosphate deficient soil, in lines, in small plots with a split block design. All treatments were tried with and without a basal dressing of sulphate of ammonia to supply 20 lb. nitrogen per acre. Early variety of paddy T. 608 of 120 days' duration was used for the experiment. The experiment has been conducted for two cropping seasons at the farm area and the yield data obtained during the two seasons reveals that treatment with solutions of chemicals K_2HPO_4 and K_3PO_4 gives yields significantly higher than that of control. There was, however, no significant difference between concentrations of chemicals, except with $(NH_4)_2HPO_4$, which at higher concentrations 2M and M depressed the germination considerably and pulled down the yield. All the chemical treatments affected the germination of seed and stand in the treated plots was about 10-15% lower than that in the control plots. The effect on germination was, however, less at concentration M/2 than at higher concentrations. Mean yields in lbs. per acre for chemical treatments at concentration M/2 are given in the following table:

No.	Chemical	Stand at harvest	Yield in lb./acre	% over control
1	KH_2PO_4	87	835	101.3
2	K_2HPO_4	92	1003*	121.7*
3	K_3PO_4	94	951*	115.4*
4	$NH_4H_2PO_4$	92	930	112.9
5	$(NH_4)_2HPO_4$	89	839	101.8
6	NH_4HPO_4	98	912	110.7
7	Na_2HPO_4	92	924	112.1
8	$(NH_4)_2SO_4$	94	783	95.0
9	NH_4NC_3	89	920	111.6
10	Cow-dung paste	76	901	109.3
11	Water-soaked	93	877	106.4
12	Untreated control	100	824	100.0

* Significant at 5% level.

It is seen that chemicals K_2HPO_4 and K_3PO_4 at concentration M/2 give yield increases of 21.7% and 15.4% respectively, over a control yield of 824 lb. per acre. At higher concentrations, the yields obtained were lower than that at concentration M/2.

Further experiments to study the efficacy of this mode of seed placement of fertilizer at different locations, levels of soil fertility and for different durations of rice varieties are being tried. The method is also being field tested on a large scale on cultivators fields and fuller details of these trials will be published in a separate communication.

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EFFECT OF PRE-SOWING LOW TEMPERATURE TREATMENT AND POST-SOWING LONG DURATION OF LIGHT ON THE FLOWERING IN WHEAT

THE note gives a preliminary report of the investigation by the author on the developmental physiology of wheat since 1947. Experiments in 1947-48 indicated that Pb591 (a late variety of wheat) showed significant earliness in earing (7.2 days) due to low temperature treatment of seed; exposures to long duration of light resulted in an earliness by 22-25 days. Since 1949 the growth, development and yield of two varieties of wheat, viz., Pb591 (late) and C13 (early variety), as influenced by pre-sowing low temperature treatment of seeds and post-sowing long duration of light, are under study. Pedigree seeds of two varieties were used and the plants were cultured in earthen pots of 10" diameter filled with a mixture of field soil and compost in the proportion of 2:1.

The pre-sowing low temperature treatment of seeds consisted of soaking the seeds for 7 hours in water and subjecting them to low temperature (34-37° F.) in a refrigerator for 5 weeks (11 Oct. to 15 Nov.).

Five plants were maintained for the final observations. The light treatments were given for the entire life-cycle; the long durations of light consisted each of exposures to 18 hrs. and 24 hrs.

by supplementing the natural day light by a 500 watt electric bulb kept at a distance of 6' from the ground. There were in all twelve treatments, viz., varieties 2, seed treatments 2 (vern. & cont.), and light treatments 3 (Normal day light,* 18 hrs. and 24 hrs. day light). Sowing was also done on 16th Nov. The maximum temperature ranged from 86-102° F. in light and 81-99° F. in normal day and minimum temperatures from 35-57° F. in normal day and 38-59° F. in light.

TABLE I (a) and (b)
Effect of low temperature seed treatment on flowering

Treatments	No. of days taken	Critical difference	No. of days taken		Critical difference
			C13	Pb591	
V	49.5	.86 @ 5%	44.0	52.4	1.47 @ 5%
C	55.3	1.16 @ 1%	47.7	61.5	1.98 @ 1%

Flowering was significantly (1%) hastened as a result of vernalization, the earliness being 5.8 days Table I (a). From Table I (b) it is seen that the response of the early variety C13 was significantly less (3.7 days) as compared to the late variety Pb591 (9.1 days).

The control seeds were sown as dry seeds. A separate control set was also taken in the normal day light, with seeds germinated to reach the stage of vernalized seeds. These second control seeds took 60 to 64 hrs. to show the stage of germination of vernalized seeds. The results of this trial showed that with the same stage of germination, vernalization induced an earliness of 3 days in C13 and of 7 days in Pb591. The effect of light treatments on the difference in the time taken for flowering between this second control and vernalized seeds will be investigated in the coming season.

TABLE II (a) and (b)
Effect of long duration of light on flowering

Light treatment	No. of days taken	Critical diff.	No. of days taken		Critical diff.
			C13	Pb591	
Normal day	72.2	1.04 @ 5%	64.8	74.4	1.82 @ 5%
18 hrs. "	46.0	1.40 @ 1%	40.1	52.3	2.42 @ 1%
24 hrs. "	39.2	..	32.5	44.3	..

* The normal day in the season ranged from 10½ hrs. to 11½ hrs. from sowing to flowering time.

Exposure to long duration of light hastened significantly (1%) the ear emergence; the change from normal day to 18 hrs. day showed an earliness of 26.2 days and that from normal to continuous illumination an earliness of 33 days; the difference from 18 hrs. to 24 hrs. was also significant, viz., 6.8 days Table II (a). The early variety C13 showed significantly greater response than the late variety Pb591 under both the durations of light, i.e., 18 hrs. (1%) and 24 hrs. (5%). There was, however, no significant difference in the responses of the two varieties between 18 hrs. day and continuous illumination Table II (b).

TABLE III
Interaction between varieties, long durations of light and low temperature treatment on ear emergence

Light duration	Vernalization	C13	Pb591	Critical diff.
Normal day	V	62.8	69.0	..
	C	67.0	79.8	..
18 hrs. day	V	37.8	47.8	2.55 @ 5%
	C	42.5	56.8	3.44 @ 1%
24 hrs. day	V	31.5	40.5	..
	C	33.5	48.5	..

Ear emergence represents the rupture of sheath of the terminal leaf by the growing ear. Under normal duration and 18 hrs. day light both the early variety C13 and late variety Pb591 responded significantly to vernalization, and earliness was much greater in late variety (10.8 days and 9.0 days) than that in the early variety (4.2 days and 4.7 days).

Under continuous light the early variety C13 did not show any effect of vernalization, while Pb591 showed significant earliness by 8 days.

The significant effect of long durations of light in inducing earliness in Indian wheats noted here is in agreement with the results of previous workers.^{1,2,3,4} But the effect of vernalization in inducing earliness in Indian wheats has not been reported by previous workers except Sen⁵ who reported it in late varieties. The present work indicates that both the vernalized wheats C13 and Pb591 flower significantly earlier as compared with the plants from untreated seeds of the type sown by the cultivators, but the response of the late variety Pb591 is greater. From the response of the two varieties to the low temperature seed treatment under different light durations (Table III) it is indicated that the effect of the low tempera-

ture seed treatment is significantly reduced with the increasing photoperiods, and in the case of the early variety C13 the effect is completely masked under continuous illumination.

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OIL OF CYPERIOL (CYPRUS SCARIOSUS)

The tree belongs to N. O. Cyperaceae, and it is known in Sanskrit as *Nagar Mustaka* and in Hindi as *Nagar Motha*. It occurs in damp places of Bengal, Pegu, U.P., and southern parts of India, common in Sunderban. The description of plant is given by Kirtikar¹ and also in *Wealth of India*.² The plant produces deep brown tubers with aromatic odour, which are used for medicinal purposes and the oil extracted from it as a hair tonic. Basu¹ mentions that steam distillation of tubers yield 0.075% to 0.080% of an essential oil with a pleasant odour.

The authors have found that the constants given by Basu do not tally with the constants recently determined by them. The oil was supplied by Messrs. Manaunlal Ramnarain, Perfumers, Kannauj. The yield of oil reported by them is 0.31% on the weight of tubers. The constants are:

Specific gravity at 20° C. ..	0.9898
Ref. Index at 20° C. ..	1.5130
Optical rotation ..	-9.14
Acid value ..	5.36
Saponification value ..	14.87
Aldehyde content ..	2.5%
Acetyl value ..	108.0

The oil has good fixative properties and has been found to replace patchouli oil partially.

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CORRECTION TO PREVIOUS NOTE

In the note,¹ 'Aegerita webberi on scale insects' should be corrected as 'Aegerita webberi on white flies'. The correction applies to the text throughout.

I am grateful to Dr. B. B. Mundkur for pointing out the error.

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LIFE-HISTORY OF SCHISTOSOMA INDICUM MONTGOMERY, 1906,—A COMMON BLOOD-FLUKE OF INDIAN UNGULATES

Schistosoma indicum is the commonest blood-fluke of domestic animals in India. It is associated with the nodulated hepatic cirrhosis in horses (Datta, 1933) and in sheep and goats (Rao, 1947), and possibly with 'Kumri' (Malikani, 1933), a disease of yet unknown etiology. The only report on the life-history of this blood-fluke is by Oo-Keh-Khaw, 1947, who found that a furcocercous cercaria obtained from *Indoplanorbis exustus* in Bihar proved on infection to a rabbit to be of *S. indicum*, but neither the description of the cercaria nor any detail of the experimental infection has been given. A systematic survey of the furcocercous cercariae infecting the common species of aquatic snails in Bareilly has been undertaken since July, 1949. During September, 1949, a type of apharyngeal, brevifurcous, non-ocellate, distome cercaria obtained from *I. exustus* on being administered to a clean kid proved to be that of *S. indicum*. Subsequently, another kid, a lamb and a guinea-pig were successfully infected with the same cercaria obtained from two more specimens of the snail. The kid, lamb and guinea-pig, all clean and two weeks old, were infected, the first two by the oral and the third by the cutaneous routes, with a large number of the cercaria from two specimens of *I. exustus*. The faeces of the lamb and the kid became positive for the eggs of the blood-fluke 52 and 62 days respectively after infection. The faeces of the guinea-pig remained negative for the eggs upto eight weeks after infection when it was autopsied and 376 males, 5 females and 91 pairs in copula were recovered from the portal and mesenteric blood and two mature and 24 immature males from the lungs. The female specimens from the guinea-pig were all ill-developed with no eggs

in the uterus. The kid on autopsy, 63 days after infection, yielded 536 males, 10 females and 17 pairs in copula from its mesenteric and portal veins and 36 males from its lungs. The lamb died 157 days after infection and was found to harbour 490 males and 35 females in its mesenteric and portal veins and 55 males in its lungs.

MORPHOLOGY OF THE CERCARIA OF *S. indicum*.

It is an apharyngeal, brevifurcous, non-ocellate, distome cercaria. The cercariae remain almost uniformly distributed in the water, their movements being in general similar to those of the cercaria of *S. spindalis* described by Soparkar (1921). They measure: body length 145-171 μ ; maximum width 43-55 μ ; length of tail stem 177-239 μ width of tail stem 23-32 μ ; length of furcae 68-103 μ . The cercaria is fusiform, widest in front of the ventral sucker and tapering towards the ends, the anterior end being narrower. The anterior organ is highly developed and consists of anterior and posterior portions. Its length varies from 29-35 μ . The length of the conspicuous, dorsally situated head gland is $\frac{3}{4}$ ths of that of the anterior organ. The well-developed ventral sucker measures 16 μ in diameter and is situated in the anterior portion of the last quarter of the body length. Its cavity is Y-shaped. The surface of the ventral sucker is covered with spines which appear smaller and denser when it is in a dorso-ventral position, but when the larva lies laterally, which it frequently does under a coverglass, the sucker is projected and the spines appear larger and more prominent. The mouth is ventral and sub-terminal, situated at about $\frac{1}{4}$ th of the body length from the anterior end. The oesophagus is a narrow tube which dilates distally into a rather prominent caecum at $\frac{4}{7}$ th of the body length from the anterior end. Its granular contents take up deep stain and show Brownian movements. There are five pairs of penetration glands (Fig. 1), filling up most of the space between the caecum and the posterior end of the body. The contents of the anterior two pairs are coarsely granular and acidophilic and those of the three posterior pairs are finely granular and basophilic. However, in the cercaria from a snail which was kept in the laboratory for about two months the glands showed very little difference in granulation and staining reaction. The ducts are moderately thick, the width of the bundle of ducts of each side at the level of the middle region of the nerve mass being a little less than a third of the width of the nerve mass. The tip of each duct is swollen and capped by a hollow spine. There

are four pairs of flame cells in the body and one pair in the tail stem. The general arrangement of the excretory system is shown in Figs. 1 and 2. The genital rudiments are represented by a ball of cells situated ventrally behind the acetabulum. It has almost the same diameter as the acetabulum. The cells stain

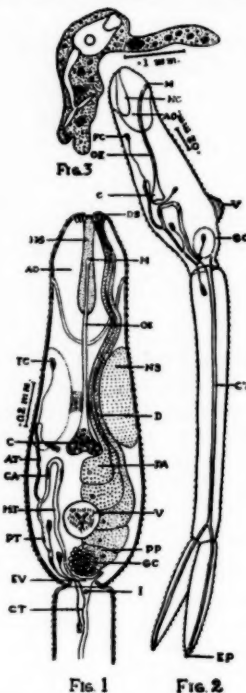


FIG. 1. Cercaria of *S. indicum*, ventral view showing along with other structures, penetration glands on one side and excretory system on the other.

FIG. 2. Cercaria of *S. indicum*, lateral view.

FIG. 3. Secondary sporocyst of *S. indicum*.

AO—Anterior organ; AT—Anterior collecting tubule; C—Caecum; CA—Ciliated area; CT—Caudal excretory tube; D—Ducts of penetration glands; DS—Duct spines; EV—Excretory vesicle; FC—Flame cell; GC—Germ cells; HG—Head gland; I—Island of Cort; M—Mouth; MT—Main lateral collecting tube; NS—Nervous system; OE—Oesophagus; PA—Anterior penetration glands; PP—Posterior penetration glands; V—Ventral sucker; PT—Posterior collecting tube, deeply in vital stains. In specimens fixed in hot Bouin's fluid the genital rudiments become beautifully preserved and can be made out even without staining. The number of cells appears to be large and in one focus about forty or more could be counted. The nervous system is

represented by two prominent hemispherical masses situated in the middle third of the body. The length of each mass is slightly less than one-third of that of the body, and the maximum width is about $\frac{2}{3}$ ths of the width of that portion of the body. The two masses are joined in the middle by a narrow strand of tissue. The body, tail stem and furcae are provided with rather prominent posteriorly directed spines.

The infected livers of snails are light yellow in colour and the lymph spaces are found packed with sporocysts and free cercariae. The sporocysts (Fig. 3) are very thin walled and measure 300 to 714 μ in length and 29 to 70 μ in width. Generally, a sporocyst contains one mature cercaria at a time and numerous germ balls of various sizes. The maximum number of maturing cercariae observed within a sporocyst was three.

The investigations are being carried out under a scheme financed by the Indian Council of Agricultural Research. The authors are grateful to Dr. S. Datta, Director, Indian Veterinary Research Institute, for his keen interest and guidance in this work and to Dr. H. N. Ray, Officer-in-charge, Section of Parasitology, for providing facilities.

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TURPENTINE OIL AND ROSIN FROM *PINUS KHASYA* (KHASHI PINE, DIENGKSEH OR SARAL)

Pinus khasya occurs not only in the Khasi Hills from where the name is derived, but also in other hills in the State of Assam. Hitherto this tree, which is a potential source of resin, has been exploited in the State of Assam to a limited extent, only for raising timber and fuel. The pine tree forms more or less pure forests.

Recently the Government of Assam appointed one of us (B. Saikia) for the development of Forest Industries in Assam and in this connection a study was undertaken to explore the industrial possibilities of oleo-resin from *Pinus khasya*. The oleo-resin was obtained from the

trees by making incisions in the wood and collecting the exuded resin flowing down the blaze over a metal lip and collecting in a conical earthen vessel or cup. The quantity of resin collected from individual tree varies according to the period of freshening of the cut, the weather and the size of the tree, being a maximum in the warm season. From experiments made so far, the yield per tree in the Khasi and Jaintia Hills (diameter 12 to 18 in.) had been estimated to be between 5 to 6 lb. per tapping season. The feasibility of utilising the Khasi pine trees for resin-tapping and subsequent processing, was never investigated in the past.

The oleo-resin from the Khasi Pine is generally semi-solid or viscous with a light yellowish to white creamy colour and a fine smell. Six samples of resin 100 g. each, from the Khasi Pine from different localities were examined. The samples contained some impurities in the form of dirt and wood-chips. The suspended water was drained out and the samples were individually subjected to steam distillation. The yield (average of six samples) of oil and rosin are given below:

TABLE I

Yield of turpentine and rosin from 100 gm. resin

Samples (100 g. each)	Average value
1 Yield of oil of turpentine g.	23.4
2 Yield of rosin g.	67.6
3 Suspended impurities g.	1.0
4 Moisture g. (by difference)	8.7

The oil and rosin obtained were further examined. The oil was found to be a colourless mobile liquid, highly inflammable and with a characteristic odour and showing the following properties of turpentine: Specific gravity (15.5° C.), 0.8640-0.870; refractive index,

TABLE II

Temperature range ° C.	Refractive index, 25° C.	Optical Rotation, 95-04 mm. tube at 20° C.	Specific Gravity 15.5° C.	Percentage distilled
1 100-50	.. ..	.. ..	.. ..	2.0
2 154-56	.. 1.4721	.. 5.7	0.8703	74.0
3 156-58	.. 1.4735	.. -8.8	0.8937	14.0
4 158-60	.. 1.4737	.. ..	.. ..	5.0
5 160 and above (residue, yellowish and sticky)	.. 1.4885	.. ..	.. ..	5.0 (by difference)

1.4730-1.4760; optical rotation observed in 95.04 mm. tube (20° C.), -6.7° to -7.0° .

The rosin is a transparent golden yellow solid with the following properties: Specific Gravity (15.5° C.), 1.064 to 1.085; Saponification Value, 170.0 to 176.3; Acid Value, 166.6 to 173.4; Melting Point, 70° to 72° C.

The oil on further fractionation showed the characteristics given in Table II.

Our thanks are due to Mr. P. D. Stracey, Senior Conservator of Forests, Assam, for his interest in the work and to Major S. C. Dutt, Director of Public Health, Assam, for his permission to carry out the work at the Provincial Public Health Laboratory, Shillong.

B. SAKIA.

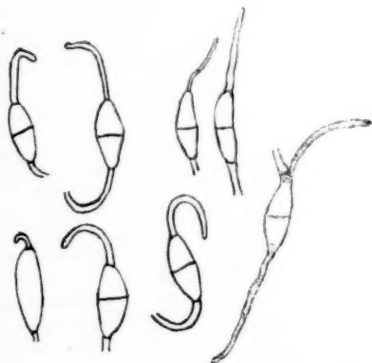
Prov. Pub. Health Lab.,
Assam, Shillong,
February 1, 1951.

P. K. DAS.

B. K. DATTA ROY.

A HYPERPARASITE ON TWO SPECIES OF *KORDYANA* RAC

KORDYANA is represented at Bapatla by two species, *K. indica* Gäum. and *K. celebensis* Gäum. occurring respectively on *Commelina benghalensis* L. and *C. attenuata* Koern. It was observed that a number of bicellular, ciliate spores occurred in the hymenia of both the species. These were found to belong to a different fungus, apparently parasitic on *Kordyana*.



Monotrichum commelinæ conidian, one germinating; $\times 720$.

The hyperparasite was first observed in November, 1950, nearly a month after *Kordyana* had first been observed and conidia were more frequently encountered in December, 1950, and January and February, 1951. The conidiophores are hyaline, often curved and appear to arise individually from the substomatal hyphal stroma of *Kordyana*. They emerge through the stoma and bear apically one conidium each. The

conidia are distributed irregularly among the basidia of *Kordyana*. They are two-celled, elliptical, sometimes with one side flattened, smooth, hyaline, each provided with a hyaline, curved cilium at the apex. They measure $10-17.5 \times 4.0-6 \mu$. The cilium is upto 18μ long and 1.5μ wide. The conidia germinate in distilled water in 6 to 8 hours by giving rise to one germ tube from one or both ends. Sometimes the septum beneath the cilium appears to dissolve, the granular protoplasm of the upper cell collects at the base of the cilium and the latter elongates functioning as a germ tube (Fig. 1). Attempts to bring the fungus into culture by transferring germinating conidia to different media failed.

Gäumann¹ has described *Monotrichum commelinæ* on leaves of *Commelina benghalensis* associated with *Kordyana celebensis* Gäum., as the only representative of the genus. He has suggested that it is probably parasitic on the latter in a manner similar to species of *Tuberulina* on rusts. The fungus described above appears to be the same species though the spores have a slightly wider range of length. Its association with the two species of *Kordyana* seems to lend strength to Gäumann's suggestion regarding its parasitism. *K. indica* is a new host for the fungus.

Gäumann placed *Monotrichum* in the Mucedinaceæ. Clements and Shear² included it in the Melanconiales. Ainsworth and Bisby³ regard it as a genus of doubtful taxonomic position belonging to the Moniliales.

I am grateful to Mr. T. S. Ramakrishnan, Government Mycologist, Coimbatore, for valuable suggestions.

Agricultural College,
Bapatla,
July 29, 1951.

K. V. SRINIVASAN.

1. Gäumann, E., *Ann. Mycol. Berl.*, 1922, **20**, 257-71.
2. Clements, F. E., and Shear, C. L., *The Genera of Fungi*, 1931, p.198. 3. Ainsworth, G. C., and Bisby G.R., *A Dictionary of Fungi*, 2nd. Ed., 1945, p. 393.

STEMPHYLLIUM ILICIS ON LIVISTONA MAURITIANA WALL.

A CHARACTERISTIC leaf-spot of the garden palm *Livistona mauritiana* Wall was observed by the author in January this year. Subsequent surveys showed that the disease was prevalent in most of the nurseries and gardens at Lucknow and Allahabad. Out of a stock of 140 plants in the University Gardens, Lucknow, 56 plants were affected by this disease. They were kept under observation and it was found that

within a month the affected leaves were destroyed.

The earliest visible symptoms of the disease are etiolation and appearance of certain yellowish brown patches in the affected regions. These patches in due course take a definite oval or spherical form and are about $\frac{1}{2}$ -1 cm. They arise at regular intervals on the segments, mainly in the mid-portion and there may be 5 or 6 rows of these on each leaf. After some time the spots increase in size mainly in the longitudinal direction and this process leads to coalescing of the spots. In the later stages greyish black specks appear on these patches due to preponderance of conidia; finally perforations arise resulting in premature drying and withering of the leaves.

Microscopic examination of these spots showed conidiophores coming out through perforations in cuticle or through the stomata. In the sections hyphal ramifications could be seen all over but were mainly profuse below the epidermis.

Isolations were made from the infected parts under sterile conditions. Invariably pure monohyphal cultures of the fungus were obtained and the fungus was identified as *Stemphyllium ilicis* (Tengwall, 1924).

The fungus grows well on synthetic agar medium. It forms a striated light grey colony which in due course becomes sooty black and is about 1 mm. in thickness. In later stages the colony sometimes gets covered by a frayed cob-web like mycelium. Hyphae are sub-hyaline, septate, branched and 2μ - 5μ in width. Conidiophores arise as side branches from the

hyphae. They are olivaceous brown, septate, unbranched and 3.5μ - 5μ width. Distance between septa in the conidiophores is less as compared with that of the hyphae. On the conidiophores several conidia are borne in botryose arrangement which generally get detached but their position can be marked by the crooked scars at short intervals on the conidiophores. Conidia are always borne singly and are rather variable in shape, depending upon the age. They arise as unicellular spherical bodies but later develop septations and become obclavate in shape. Septa are always transverse and may be 1-6 depending upon the age of the conidia. In colour they are buffy brown at first but later on become dark brown. In size they are 12μ - $43\mu \times 7\mu$ - 11μ .

These characters tally with the diagnostic characters of *Stemphyllium ilicis* as enumerated by Neergard.¹ As far as known to the author this is the first record of this fungus on palms.

It, however, remains to establish the actual relationship of the fungus with the host which will be possible after performing infection experiments in the coming rainy season.

My sincere thanks are due to Prof. S. N. Gupta for his valuable guidance.

Dept. of Botany,
University of Lucknow,
Lucknow,
July 10, 1951.

M. KAMAL.

1. Neergard, P., Danish spp. of *Alternaria* and *Stemphyllium*, p. 321. Einar Munksgaard, Publisher, Oxford University Press, London, 1945.

DR. PATRICK C. YOUNG

DR. PATRICK C. YOUNG succeeds Dr. Alexander Wolsky in Delhi as Head of the UNESCO Science Co-operation Office for South Asia.

From 1934-39 Dr. Young was with the Imperial Chemical Industries as Plant Manager and Technical Officer in the production of 'hermosetting' plastics, and in developing plastic applications in a great number of British industries.

During the War he held executive positions for three years as Chief Engineer and Technical Manager in enterprises associated with aircraft production before returning to the field of plastics as Manager of the group of works

of the then largest self-contained productive enterprise in Britain in the Plastic Moulding Trade.

In January 1948, on the recommendation of the British Chancellor of the Exchequer he was invited to act as Consultant to the United Nations Economic Commission for Asia and the Far East, and participated in this capacity in the deliberations of the Working Party on the Industrial Development of Asia and the Far East which reported to the Ootacamund Conference of ECAFE in that year.

We wish him a very happy and successful tenure of office.

REVIEWS

Theory of Groups and Its Applications to Physical Problems. By S. Bhagavantam and T. Venkatarayudu. II Edition. Andhra University, Waltair, 1951. Pp. vii+277. Price Rs. 20.

The popularity of the book is indicated by the fact that the first edition has become out of print in less than three years. The new edition is practically a reprint of the first but for some minor alterations and additions. Written specifically to meet the needs of physicists, the book rightly emphasises the results of the theory and the methods of applying it to various problems, in preference to mathematical rigour. Proofs of theorems are relegated to appendices, where the interested reader can find them, thus keeping the treatment in the main chapters coherent and continuous.

Group theory is finding more and more application in various branches of physics—Crystal Symmetry, Crystal Physics, Band Spectra, Molecular Vibrations and Quantum Mechanics—and all these aspects are considered in this book. The authors were the pioneers in this country in the application of group theoretical methods to the study of Raman Spectra. Most of the examples in this field have therefore been drawn from the original investigations of the authors. One only regrets that the more recent work of the French school has not been touched upon in this new edition.

Printing is excellent, although a few errors are occasionally found, e.g., 'Right' for 'Rigid' in p. 65, l. 17 and Σ for Ξ in p. 79, l. 21. But the binding and get-up are not up to the mark; these should be improved even at the risk of increasing the price.

Die Chemische Affinität: By Egon Widberg. (Walter De Gruyter & Co., Berlin). Pp. 254+xii, 36 Figures. Price DM 24.

The volume under review is an introduction to the driving force of Chemical Reactions and is stated to be based on a course of lectures in the University of Munich. The volume is divided into three main sections each devoted to one of the Laws of Thermodynamics. The short first section gives an elementary account of reaction heats and of Hess' Law. A consideration of the Free Energy change in chemical reactions is found in the second section covering about 100 pages. The mechanical and elec-

trical work performed by chemical reactions is considered and the treatment covers normal electrode potential, decomposition potentials and overvoltage. At each stage suitable examples from technical and academic angles are chosen to illustrate the points considered. The Born-Haber cycle is introduced and in the last section the third law and entropy changes are discussed. The treatment on the whole is very elementary and at best useful to a beginner. Considering the elementary treatment, the language in which the volume is written and the relatively high price, it is not likely to be of any great use in this country. The get-up and printing of the publication is very good.

S. V. ANANTAKRISHNAN.

South African Scenery: By Lester C. King. (Oliver and Boyd, London and Edinburgh), 2nd Edition, 1951. Pp. xxxii+379. One coloured map, 266 plates, 79 text-figures. Price 45 sh. nett.

One of the earliest books on scenery in relation to geology was from Archibald Geikie's powerful and prolific pen—the *Scenery of Scotland*, published half-a-century ago. But in recent years several excellent books have come out from America, generally very finely illustrated. As examples we may cite the books on Geomorphology by Van Engeln and Lobeck.

The book under review concerns itself with South Africa though there are fairly frequent references to parts of East and Equatorial Africa. It is of interest not only to the inhabitants of Africa but also to others who wish to know something of that continent, its geology, geographical evolution, land forms and scenic interests.

The book is divided into 21 chapters. Commencing with a general introduction of Geomorphology it proceeds to treat of weathering; development of rivers, hill slopes, erosion cycle; work of wind and the arid cycle; work of groundwater, the sea, glaciers and volcanoes; movement of land, uplift and depression. The four closing chapters deal with the geomorphology of the several natural regions of Southern and Equatorial Africa.

Written by a Geologist (the author being a Teacher of Geology in the University of Natal), the causes and effects of natural geological processes are adequately explained but without making the book too geological in treatment.

The reader would find an excellent treatment of the erosion cycle and particularly soil erosion, its effects and its remedies. This last topic has now caught the imagination of even politicians, and civil engineers. The author has something to say about the destructive activities of man in this regard: "Some of the Union's finest forest and agricultural lands have been ruined by overstocking and careless tillage, deforestation has left a trail of destruction in more than one locality, while his civilized tinkering with the flow of rivers, the action of the sea and erosion generally, have often rebounded more to his surprise than to his credit". The author states that the destruction of the vegetal cover in Northern Nigeria and surrounding areas has resulted within 200 years in the depopulation of a country as large as the Union of South Africa. The wrong practices followed by both the white and black man alike in the matter of the use of land have created the South African desert, which is apparently gradually spreading out.

In the chapter on the work of the wind, desert features are well described. For the fixation of drifting sand dunes and of moving masses of sands along sea coasts, certain plants such as *marram grass* have been found to be useful. After growing grass as the first step, later fixation can be done by wattle or Port Jackson willows which have been used in South Africa.

We learn from this book the interesting fact that man's nearest relation in the animal kingdom, namely the baboon, is also a destructive geological agent. It appears that troops of baboons roam about the country turning over an enormous number of stones, rolling them down the hill side, in search of lizards and scorpions which apparently form articles of their food. We also learn that white-ants build ant-heaps 15 ft. high and 40 ft. across at the base, at intervals of a few yards, in parts of Northern Rhodesia and Congo. Judging from this the white-ants must be more destructive in South Africa than in our country.

An interesting chapter (Chapter XVIII) deals with the evolution of the morphology of South Africa and this is treated as a succession of erosion cycles. The four major land-surfaces are called *Gondwana*, *African*, *Victoria Falls* and *Congo*, which are related to such cycles. Each of these is found to constitute a rather complex surface which might perhaps require some modification as our geological knowledge of the Continent grows.

The book is well illustrated by as many as 266 plates, many of which are interesting as

well as instructive. It is lucidly written and can be read with profit not only by geologists and geographers but also by others who wish to learn something of the surface of the earth on which we live. The author and the publishers should be congratulated in bringing out the second edition of this fine book.

M. S. KRISHNAN.

Six-Membered Heterocyclic Nitrogen Compounds with Four Condensed Rings. By C. F. H. Allen and Five Collaborators. Interscience Publishers, New York, 1951. Pp. 358, 7 illustrations and 40 tables. Price \$10.00. Special subscription price: \$9.00.

The second volume in the series "The Chemistry of Heterocyclic Compounds" is a great improvement on the first, which left the impression that too heavy a price was being charged for too little material. In view of the large number of monographs in which heterocyclic chemistry is to be treated in the Interscience series, and of the fact that two volumes of another series on heterocyclic compounds have appeared (Wiley, New York, 1950), it is possible only for institutional libraries to purchase the series; and many libraries with limited resources will have to make a choice between the two. However, the present volume will be a most valuable addition to the private library of any worker in the heterocyclic field, although it is limited in scope to the seven ring systems consisting of four fused benzene rings in which a methine group (and not a carbon atom common to two rings) is replaced by nitrogen. The book is a model of scholarship; it is comprehensive and clearly written; the references, particularly to patent literature, are exhaustive. In pleasing contrast to Morton's *Chemistry of Heterocyclic Compounds* (McGraw-Hill, 1946), equations and formulae are very clear and readily understandable. Nomenclature and numbering are systematic; in addition to the *aza* names which are generally used and shown in bold type against each ring system, Chemical Abstracts and other names and the Ring Index number are given. Each section concludes with a table in which nearly all the reported compounds of the given type are listed, together with the physical properties and the sources of information.

The importance in the drug and dyestuff industries of the heterocyclic skeletons with which the book deals is somewhat exaggerated; but their fundamental interest is beyond question, and the treatment is so excellent and stimulating that the book can be read and repeatedly used with profit by organic chemists

concerned with widely different problems of degradation and synthesis of naturally occurring substances, biologically active compounds or synthetic dyes. Pointed attention is drawn in every chapter and section to gaps in our knowledge; passages such as the following are typical: "The few known compounds which possess the 7H,1-azabenzanthrene nucleus are, in fact, 1-azabenzanthrones (III).....The only available source of information on these compounds is in a series of patents granted to the I. G. Farbenindustrie to cover their use as dyes or dye intermediates. In view of this, many of the structures are unknown, or not definitely established; on the whole, descriptions of the compounds are sketchy" (p. 204). "There are four hundred ninety-five possible arrangements for the tetrazabenz(a)anthracenes, but only two have been prepared." The literature is reviewed critically with an emphasis on the incompleteness or unsatisfactory character of data and on uncertainties in the structures assigned to compounds.

The symbol at the back of the book is not happily chosen, since it represents the fusion of four rings, each of which contains nitrogen.

The literature has been covered through 1950, but a few omissions have been noticed. Bally showed that his "benzanthronequinoline" had an angular orientation with reference to the anthrone ring, but not that the compound was 5(N):6-pyridinobenzanthrone; its constitution as 8:9(N)-pyridinobenzanthrone (I) has been proved by its synthesis from 9-aminobenzanthrone (*Proc. Indian Acad. Sci.*, 1950, 32A, 39). It is stated in p. 81 that the structure (I) for Bally's compound has "since been confirmed", but no reference is cited.

The Colour Index numbers cited for Alizarin Green S, Blue S and Grey SD are erroneous, but they coincide with the Schultz numbers. "Naphthoylpicolinic acids" in p. 6 should read as "naphthoynicotinic acids". Quaternary ammonium salts are occasionally shown with five covalent bonds. Why should an aldehyde be called a "carboxaldehyde" (p. 58)? "Sulphate" in p. 65, line 13, should be "sulphite". Are complex molecules derived from 2-keto-3-azabenzanthrones "commonly employed as vat dyes" (p. 219)? After the lengthy discussion in p. 102-07 and the reference to de Diesbach's 1949 work in p. 111, Posner's 1926 structure is given in p. 222; incidentally, what is the difference between structures (XXX) and (XXX a)? Formula (XXX b) in p. 102 contains a trivalent carbon atom and one too many hydrogen atoms. Alkylation of 3-azabenzanthrone is much more likely to take place in the 4- than in the 5-

position (p. 222). Compound (XVI) will not have vat dyeing properties; the vat dyes mentioned in the patents under reference are prepared by condensing the bromoazabenzanthraquinone (XVI) with 1:5-diaminoanthraquinone, etc.

It is stated in p. 21 that "the only syntheses of the 1:3-diazanaphthacene ring system appear to be those described in two related I.G. patents"; an intermediate for Indanthrene Green 4G is 4-chloro-2-phenyl-1:3-diazanaphthacene-6:11-quinone (B.I.O.S. Report, 1493); see also I.G., B.P. 476,599; 494,168).

Some economy in the cost of printing might have been effected by not repeating structural formulæ such as (VI) in pp. 4, 5, 6; (VIII) in p. 64; (IV) in pp. 211, 216; (XIV) in pp. 214, 215; (XXXIV) in pp. 224.

K. V.

Hollman Organic Chemistry. By J. P. Wibaut, translated from the Sixteenth Dutch Edition by S. Coffey. (Elsevier Publishing Company, Cleaver-Hume Press, Ltd., 42-a, South Audley St., London W.I.), 1951. Pp. xiv+660. Price 15 sh.

Since the appearance in 1930 of an English edition of Hollman's *Textbook of Organic Chemistry*, several fundamental advances and far-reaching developments have taken place in the field of organic chemistry. The task of adapting and modernising that familiar book, taking especial care to retain its original character and appeal of treating the subject-matter from the standpoints of organic chemical theory of structure and physicochemical aspects, is hard, particularly because of the length of the present publication and Prof. Wibaut has indeed been largely successful. Nevertheless, necessary additional space may well have been devoted to more detailed formulation of the Electronic Theory, its scope and limitations and the interpretations of many of the organic chemical reactions otherwise adroitly handled and to more information about the biologically important penicillins, other antibiotics, hormones and vitamins. However, the present edition will constitute an excellent textbook for chemistry students of the B.Sc. level of most Indian Universities. Its advantageous use is indicated to biological and medical students and to research workers in fields other than organic chemistry.

There are a few misprints and errors of oversight or of typographical nature. The deletion of 'here' from l. 8 on p. 5 and substitution of 'abandoning' for 'abandonment' in l. 10 of same page and 'ionic' in place of

'ionogenic' in l. 33 of p. 6 will surely be improvements. The statement that 'nitrogen escapes as such' in lines 19-20 on p. 8 obviously needs modification. Numbering of formulæ at the top of p. 371 as I-IV has been omitted as also "c" in ferric and 'ous' in ferrous in l. 21 and 'h' in diphenylbenzoquinone in l. 25 of succeeding page, 'I' in 'material' in l. 16, p. 386, oxide in l. 13, p. 377, 'combating' in l. 38, p. 386, 'acetyl' in l. 18, 'dione' in l. 19, and 'produced' in l. 21 of p. 513 are mis-spelt. The expressions "Sulphapyridine is used in medicine against infectious diseases caused by streptococci (only). It has a similar action to Prontosil and nicotonic acid and nicotinamide are of importance in biochemistry" certainly need obvious revisions. These are minor criticisms not seriously militating against the scope and usefulness of this characteristically well-printed Elsevier publication.

S. RAJAGOPALAN.

Papain. By M. L. Tainter and others. *Annals of the New York Academy of Sciences*, Vol. 54, New York, 1951. Pp. 154. Price \$3.00.

In spite of the fact that Papain is one of the long-known and widely employed enzymes, published literature on the subject, except for references to the enzyme in books on Enzyme Chemistry, is surprisingly meagre. The sterling—Winthrop Research Institute, which is particularly interested in this scientifically interesting and commercially important enzyme, has taken an enlightened interest in this subject and arranged to "send one of its staff into the field to study optimum conditions of collecting and drying the latex and possible means of stabilising the potency of the resultant powdered Enzyme. These studies led to extended consideration of available methods of assay and finally to the digestive activity *in vitro* as well as *in vivo*". The above studies together with a very comprehensive, up-to-date and critical review of the literature on papain, have been presented in the *Annals* (Vol. 54, pages 143-296). Photographic reproductions of papaya plantations, the methods of tapping and drying the latex which illustrate the pamphlet, enhance the usefulness of the volume. The annual production of the crude enzyme has been estimated at 500 tons and there is a good prospect of increasing this output in many of the tropical countries including India and Ceylon. In addition to the enzyme, the plant as a source of valuable and nourishing fruit, is well recognised. The volume under review has brought together information pertaining to all these scientific and economic aspects of the subject. It will be found

an invaluable and inspiring guide both to the scientist and to the manufacturer interested in the subject of papain.

The Fishes of the Indo-Australian Archipelago.

Volume IX. (Percomorphi concluded; Blennioidea). By L. F. de Beaufort with the collaboration of W. M. Chapman. (E. J. Brill, Leiden), 1951. Pp. 1-xi+1-484 with 89 illustrations.

The students of fish and fisheries of South-East Asia and of the adjacent countries are, no doubt, fully familiar with the very famous work on Indo-Australian Fishes by the two well-known Dutch Ichthyologists, Prof. Max Weber and Prof. L. F. de Beaufort. The senior author, who had planned this work and devoted more than 25 years of his long and laborious life to its advancement, died on February 7, 1937, when only 7 volumes of the series had been published.* The eighth volume, which was published during the War, was dedicated to the memory of Prof. Max Wilhelm Carl Weber by Prof. L. F. de Beaufort. The next volume has now appeared after a lapse of eleven years. It is, therefore, a great event in the history of ichthyology in this part of the world.

As explained in the Introduction, the material for it had been prepared in the War years 1941-44. There have, however, been several reasons for the delay in its publication. Firstly, printing was difficult during the later periods of the War and after the War, the Press has been crammed with more urgent work. Secondly, the author, having reached the age limit of 70, had to retire as Professor and as Director of the Zoological Museum at Amsterdam. Thirdly, the notoriously difficult genus of *Salarias* (Blenniidae) had to be entrusted to Professor W. M. Chapman for revision, who has contributed the material for pages 243 to 355 of the volume and is thus the author of the description of the family characteristics of the Blenniidae, of the key of the family, of the descriptions and synonymy of the first eight genera of the Blenniidae and of the descriptions and synonymy of the species belonging to these genera. In acknowledging the help of Professor Chapman, the author very graciously states that 'As a consequence, this part of the volume is far superior to what I could have written'. The ichthyologists of the Indo-Pacific region are thus grateful to Professor Chapman 'for having given this work priority over other urgent activities'.

* The dates of publications of the various volumes are as follows:—Vol. I, 1911; Vol. II, 1913; Vol. III, 1961; Vol. IV, 1922; Vol. V, 1929; Vol. VI, 1931; Vol. VII, 1936; Vol. VIII, 1940, and Vol. IX 1951.

As usual, this volume is well printed and got up, and the publishers are to be congratulated on the excellence of the series.

Professor L. F. de Beaufort disclosed the plan of the remaining volumes to the reviewer as early as March 15, 1948. The text of the tenth volume on Gobioidae by Dr. F. P. Koumans has been ready for some years and is now likely to be published soon. Volume XI will deal with Scleroparei, of which Hypostomides (Pegasi-formes) had already been worked out in 1948. Discopcephali, Xenopteri, Pediculati, and perhaps the Opisthomi will also be included in this volume. Volume XII will contain an account of the Plectognathi, while the last Volume XIII will deal with Rays and Sharks. Dr. Koumans had started work on the Rays and Sharks, but now that he has given up ichthyological studies, work on this volume may have to be undertaken by Dr. de Beaufort himself.

It is a matter of great pleasure to learn that the young Republic of Indonesia has decided to promote the issue of this meritorious publication in the same way as has been done previously by the Dutch Government. For this enlightened policy, ichthyologists all over the world are deeply indebted to the Government of the Republic.

S. L. HORA.

Methods of Vitamin Assay. Second Edition.

Prepared and Edited by the Association of Vitamin Chemists, Inc. (Interscience Publishers, Inc., New York), 1951. Pp. xviii+301. Price \$5.50.

Assay of the vitamins constitutes a very essential and vital part of analytical biochemistry. The difficulties and complexities which confront the analyst, particularly those who have to deal with natural products, are well known to investigators in the field. Workers in different laboratories have, in the course of overcoming these difficulties and simplifying the complexities, have from time to time, arrived at improvements in vitamin methodology directed towards the attainment of greater specificity, accuracy and reproducibility. Such painstaking attempts have been carefully chosen, critically evaluated and their worthiness for adoption as standard procedures, appraised by the Association of Vitamin Chemists Inc. Agreement on the standard methods has been reached only after a series of independent trials in different laboratories. The methods described in this volume are thus "the result of the pooling and interchange of information on analytical techniques and thus represent the combined knowledge and experience of many persons".

The second edition of this volume reflects increasing experience with vitamin methodology. "It includes assays for several members of the Vitamin B Complex for which methods were not described in the first edition, namely, pantothenic acid, pyridoxine, folic acid, biotin, Vitamin B₁₂ and a chemical analysis for riboflavin." The volume has been brought up-to-date by incorporating suggestions and reports of experiences from different laboratories. The Association wishes once again to invite comments, suggestions, recommendations, etc., in order that improvements in vitamin methodology may be continued. The volume is indispensable not only for the analyst but also to every research worker. The Association of Vitamin Chemists has earned the gratitude of all investigators interested in vitamin methodology for organising the publication of what may deservedly be regarded as the most authoritative volume on the assay of vitamins.

The Chemistry and Technology of Food and Food Products. Edited by Morris B. Jacob. 3 Vols. (Interscience Publishers Inc., New York), 1951. Vol. I. Pp. xxv+832. Price \$12.00.

The present review relates to Volume I only. This volume is divided into three parts. Of these, Part I on 'Fundamentals' is the same as in Volume I of the first edition. Two new parts added are, Part II on 'Unit Operations and Processes' and Part III on 'Sanitary and Quality Control'. Part I forming more than half of the volume is a repetition of material better read in any textbook of Biochemistry. It is not necessary to repeat here the criticism of the book, for, it is already covered in a review of the first edition* of the book. We can only hope that in later editions, among other things, at least a better edited introductory chapter will be presented in the interests of this treatise as an occasional reference work.

The paper used for printing the present edition is, however, of a better quality than the one used in the previous edition and this is, perhaps, one of the factors for its enhanced price.

S. N.

* *Journal of Scientific and Industrial Research*, 1946, 5, 131, by the present reviewer.

Books Received

Stainless Iron and Steel, Vol. I. By J. H. G. Monypenny. Chapman & Hall, 1951. Pp. xi+523. Price 45 sh. net.

The Pectic Substances. By Z. I. Kertesz. Interscience Publishers, Inc., 1951. Pp. xvi+628. Price \$13.50.

Radio-Chemical Studies—Fission Products. Books 1, 2 and 3. Edited by Charles D. Coryell & Nathan Sugarman. McGraw-Hill International Corporation, 1951. Pp. xxx+518, xvi+519 to 1315 and xx+1316-2086, respectively. Price \$18-50 per set.

The Invertebrates, Vol. III. By Libbie Henrietta Hyman. McGraw-Hill Book Corporation, 1951. Pp. viii+572. Price \$9-00.

The Chemistry of Uranium. By Joseph J. Katz and Eugene Rabinowitch. McGraw-Hill Book Corporation, 1951. Pp. xxii+610. Price not given.

Experiment in Dental Care, W.H.O. Monograph No. 4. By J. J. Fulton. W.H.O. Palais des Nations, Geneva, 1951. Pp. 87. Price \$1-00.

Elementary Genetics. By Wilma George. Macmillan & Co., 1951. Pp. iv+172. Price 10 sh. 6 d.

Adhesion and Adhesives. By N. A. Debruyne and R. Honwink. Clever Hume Press Ltd., 1951. Pp. xvi+517. Price 70 sh.

The Enzymes, Vol. II, Part I. By J. B. Sumner and K. Myrback. Academic Press, Inc., 1951. Pp. xii+790. Price \$14-80.

The Fundamental Aspects of Lubrication. Edited by Roy Waldo Miner and 14 others. New York

Academy of Sciences, 1951. Vol. 53, Art. 4. Pp. 753-994. Price \$4-00.

Specific Methods of Analysis. By S. E. Q. Ashley and 13 others. New York Academy of Sciences, 1951. Vol. 53, Art. 5. Pp. 995-1118. Price \$2-50.

Annual Review of Biochemistry, Vol. 20, Annual Rev. Inc., 1951. Pp. 648. Price \$6-00.

Mathematical Engineering Analysis. By Rufus Oldenburger. Macmillan & Co., 1951. Pp. xiv+426. Price \$6-00.

Elementary Calculus. By M. Lakshmanamurthi. M/s. Rao Brothers, Guntur, 1951. Pp. viii+207. Price not given.

Science in the School Garden. By Mary A. Johnstone. Macmillan & Co., 1951. Pp. xiv+176. Price 4 sh. 6 d. net.

The River Mathematics. By A. Hooper. Macmillan & Co., 1951. Pp. 370. Price 18 sh. 6 d. net.

The Oxide-Coated Cathode, Vol. 2. Physics. By S. Wagener. Chapman & Hall Ltd., 1951. Pp. xiv+311. Price 42 sh.

Surface Chemistry of Solids. By S. J. Gregg. M/s. Chapman & Hall, 1951. Pp. ix+297. Price 30 sh.

BUILDING RESEARCH CONGRESS-1951

THE BUILDING RESEARCH CONGRESS, 1951, sponsored jointly by the learned societies and professional institutions of Great Britain, the Department of Scientific and Industrial Research and the Ministry of Works, was held in London from 11th to 20th September, 1951. In India, the large influx of refugee population, the alarming increase in birth rate that is taking place and the increasing trend of the villager to settle down in towns, have all combined together to create acute housing shortage in the towns. The housing problem has become gigantic in magnitude and its solution urgent. The Congress is therefore more than of ordinary interest to us in India. The summaries of the papers which have been received indicate the fine fare one can get at the Congress.

The papers have been classified under three divisions. Those under Division One deal with the influence of mechanisation and prefabrication on techniques and cost of building, the influence of modern research on structural design and on the influence of modern soil studies on the design and construction of foundations. Papers on prefabrication of houses will be helpful in evolving more economical and quicker methods in our projects. Our experience of these

projects have not been so far happy. Papers on pre-stressed concrete and shell construction ought to aid in achieving greater economy in the use of steel, those in the new fields of research on the structural use of glued laminated timber and of light alloy sections are to be welcomed because of the increasing activity and interest shown in their use, in recent years. Papers on soil mechanics are a good contribution to our knowledge of this modern science. Division Two deals with papers on research done recently in building materials. The papers on 'Weathering and Durability of Building Materials under Tropical Conditions', and those pertaining to manufacture of bricks, making good quality concrete, using plywood as a building material and on burning and shaking lime are of particular interest to builders here in India. Papers on "the Acoustics of Auditoria and Studios", ventilating and lighting of buildings and factories, and problems pertaining to the design of three specific types of buildings (hospitals, factories and schools) have been clubbed together under Division Three. Papers on the design of hospitals, factories and schools promise to be of more than ordinary interest to designers and architects.

N. S. G.

SCIENCE NOTES AND NEWS

International Standards Meetings

The Indian Standards Institution will participate in the meetings of a number of technical committees of the International Organisation for Standardisation (ISO), to be held in London and on the continent during October and the next two months. Dr. K. L. Moudgill, Deputy Director (Chemicals), will represent the Institution at these meetings.

C.S.I.R. News

C.S.I.R. News, Vol. 1, No. 1 of which has just now appeared, seeks to convey information relating to the activities and achievements of the various organisations and institutions functioning under the auspices of the Council of Scientific and Industrial Research, India.

Mr. K. Ramiah

Mr. K. Ramiah, formerly Director, Rice Research Institute, Cuttack, has been appointed Rice Consultant to the Food and Agricultural Organisation of the United Nations.

Rome Microbiology Congress

An International Congress on Chemical Microbiology was recently held in Rome, when the new international centre for chemical microbiology was also opened. The centre, the only one of its kind in the world, will be directed by Professor Chain, F.R.S., and 15 research scholarships are being provided by the World Health Organisation.

Research on Solar Radiation

During the past few years the Australian Division of Radiophysics has studied the intensity of the radio waves from the sun, on the following wave-lengths: 3, 10, 25, 50, 300 and 500 centimetres. The Division successfully developed the technique of using spaced receivers, during an eclipse, to determine the position of high emitting areas on the sun. As a result of these observations, and of theoretical studies based on them, it is now possible to recognise a base level of radiation over the wave-length

range from one centimetre to four metres. This radiation is due to thermal emission from the hot gases of the solar atmosphere. Theoretical studies have enabled the investigators to use the radio results to estimate the normal temperature and pressure of these gases at various heights above the visible surface of the sun.

Dr. S. S. De

Dr. S. S. De of the Indian Institute of Science has left for Bangkok as Regional Nutrition Officer, Asia and South-East Regions of the F.A.O.

Nuclear Physics Plan for Europe

The creation of a European Regional Laboratory for Nuclear Physics was under further consideration at the Sixth Session of the UNESCO General Conference. The idea has been under study since the 1950 meeting, when approval was given to the setting up of such regional centres, as proposed by Professor Isidor Rabi, of the U.S.A.

Flying Spot Microscope

A "flying spot" microscope which is able to scan, magnify, measure and count about a million minute particles, such as brain cells, per second, is described in the report of the Nuffield Foundation for 1950-51, issued recently.

The instrument uses a televisor, focussed through an ordinary microscope reversed, to scan the specimen in a series of lines by means of a minute and brilliant spot of light. A photo-electric cell converts the spot's messages into electric signals, which are amplified and converted into a display on a television-viewing screen three feet square. It is believed that the new technique may revolutionize the present primitive methods of counting and measuring cells in microscopic examination.

CORRECTION TO PREVIOUS NOTE

VOL. 20, No. 1, p. 38.

In the note on "Studies on Ion Exchange", Figs. 1 and 2 are to be interchanged. Also, in Table I, $10^3 \times \text{m. eq.}$ must read as m. eq.